THE CITIZEN AND
HIS MONEY

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By

H. M. COOK, B.A.Lond., M.R.S.T.

Tutor in Mathematics and Education
at Edge Hill Training College

PREFACE

ARITHMETIC, as traditionally taught in our English schools, really embraces two subjects : the study of number ; and its application to certain customs chiefly connected with our complicated monetary system, but also involving a knowledge of methods of measuring various material substances.

In setting problems most text-book writers on Arithmetic assume a wide general knowledge on the part of their pupils and use the language of the merchant, or the receiver in bankruptcy, or the engineer, without comment, provided that the sum can be done by the rules of Arithmetic. It is true that there are chapters on Interest, and on Stock and Shares, but the impression is given that these are rules of Arithmetic unrelated to life—the equals of Fractions and Square Root.

This little book is a reader giving information about these commercial and financial terms and customs, and it is hoped that the pupils who use it will find their Arithmetic lessons more interesting, and look up points for themselves instead of expecting their teachers to provide all the background information for their calculations.

The language is that which might be used by a teacher to a class, and in the early chapters is suitable for twelve-year-olds, but there is no attempt to teach pure arithmetic, and a knowledge of the four rules as applied to integers and to vulgar and decimal fractions is assumed from the beginning, while in one chapter logarithms and geometrical progressions are used. The text can, however, be read continuously, and all examples are worked out, so that lack of mathematical ability need not deter the reader.

It is hoped, indeed, that a new point of view will help som children who are weak in pure arithmetic to make a fresh start often such pupils are very interested in the meaning of cheque, or a talk on how a company is floated, and jus as musical appreciation can be taught to quite inferic instrumentalists, so it seems foolish to limit the young citizen' outlook by his ability as a calculating machine.

Another purpose which the book may serve is as a introduction to economics and civics, and to book-keeping The author hopes, at any rate, that teachers of these subject will not find that pupils who have used this book have anything to unlearn.

Permission to reprint (on pages 57 and 58) two rhymes by Mr. Hope-Jones, of Eton, is gratefully acknowledged.

A similar book explaining scientific terms and customs and various units of measurement in common use is contemplated.

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THE CITIZEN AND HIS MONEY

CHAPTER I

WHAT MONEY IS

You have learned to count : one, two, three, four . . . and you have also learnt to count things : one pencil, two pencils . . . five hens, ten hens . . . twenty pennies, twenty-one pennies . . . ninety-nine boys, a hundred boys. When we use numbers and arithmetic in our daily life we usually refer to things, and it is necessary to write the name of the thing immediately after the number : 19 chairs, 37 shillings, 55 oranges, 18 pints. This is called " stating the unit used," and must never be forgotten when you are working sums about things instead of about numbers.

We all require food, and drink, and clothes, and shoes, and soap, and pencils, and chairs, and many other things in England to-day. In the old days people had not so many wants—they lived in caves and used the wild plants and the wild animals for food and to make simple clothes. Then came the days when they tended flocks of sheep and herds of cattle, and planted corn. Then sometimes it happened that one man had too many sheep for his own wants, and another had too much corn, so they would make an exchange. That is how barter began, but in time it became more complicated—men were not content with simply supplying each other's wants, they wished to value their possessions. Perhaps their first attempts were something like this :—

The wool from one sheep shall have the same value as a day's milk from ten cows.

120 eggs shall have the same value as a sack of corn.

The meat from one pig shall have the same value as a cart-load of hay.

After a time this became very muddling. Perhaps the man with wool to spare did not want milk, but wanted hay, and the man with the pig wanted to obtain some eggs, and

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gradually people discovered that it would be much more convenient to find something which nobody really wanted but which could be handed about more easily than wool or meat or milk or corn in exchange for any of these articles. At first they used shells for this purpose, and shells are still used in parts of Africa now. Then their valuing became something like this :—

For the wool from one sheep   give 50 shells.
For a day's milk from ten cows   give 50 shells.
For 120 eggs   give 60 shells.
For a sack of corn   give 60 shells.
For the meat from one pig   give 30 shells.
For a cart-load of hay   give 30 shells.

This changing things for shells was called selling, and when the shells were changed back into things the process was called buying. Whenever one man was selling another was buying, so the whole exchange was called " buying and selling." Nowadays we do not use shells, we use what we call money— either metal coins or paper with writing or printing on it. But it is important to remember two things :—

1. Money is a convenience, to make buying and selling easy. Nobody wants it or ought to want it for its own sake.

2. The price of anything must be agreed on between two people—the buyer thinks of it as a cost price and would like it to be small—the seller thinks of it from a different point of view, and would like it to be large, but they must agree before the exchange can take place.

Here are some of the kinds of money used nowadays.
In England we count and quote prices in pounds (£), shillings (S) and pence (D).

12 pence   = 1 shilling.
20 shillings = £1.

We pay small sums with copper coins, called farthings ($\frac{1}{4}$d.), halfpennies ($\frac{1}{2}$d.), pennies (1d.), or with silver coins called threepennybits (3d.), sixpences (6d.), shillings (1/–), florins (2/–), half-crowns (2/6), crowns (5/–). For larger sums we use bank-notes, which are issued for 10/–, £1, £5, £10, or we pay by cheque, if we have made an arrangement with a bank to be able to do so, and the seller agrees to our doing so.

You may also have seen gold coins : half-sovereigns (10/–), sovereigns (£1), and perhaps guineas (21/–). In reading you may also know the names groat (4d.), noble (6/8), and a 4/– piece used to be issued too.

In France prices are quoted in francs and centimes.

$$100 \text{ centimes} = 1 \text{ franc.}$$

Some of their coins are 5 c., 10 c. and 25 c. made of nickel, 1 fr. and 2 fr. of silver, and 100 fr. made of gold ; and they use paper money usually for sums over 5 francs.

In Belgium large sums are quoted in belgae, and smaller sums in francs and centimes.

$$100 \text{ centimes } = 1 \text{ franc.}$$
$$5 \text{ francs } \quad = 1 \text{ belga.}$$

The chief coins in use are 5 c., 10 c., 25 c. in nickel, and 50 c., 1 fr. and 2 fr. in silver.

In Switzerland also there are francs and centimes, but the nickel coins are $2\frac{1}{2}$ c., 5 c. and 20 c. ; the silver, 50 c., 1 fr., 2 fr. and 5 fr. ; and there are gold pieces for 10 fr. and 20 fr.

In Italy you will be charged in lira and centesimi.

$$100 \text{ centesimi} = 1 \text{ lire.}$$

Nickel coins exist for 20 c. and 25 c.
Silver   for 20 c., 50 c. and 5 lira, 10 lira, 20 lira.
and Gold   for 10 lira, 20 lira, 50 lira, 100 lira.

In Germany bills are made out in reichsmark and pfennige.

$$100 \text{ pf.} = 1 \text{ reichsmark.}$$

There are nickel coins for 5 pf., 10 pf., 20 pf., 25 pf.
            Silver coins for 50 pf., 1 m., 2 m., 3 m., and 5 m.
            and Gold   for 10 m. and 20 m.

In U.S.A. 100 cents = 1 dollar. The sign for dollar is $, generally written before the figures.

A five-cent piece is made of nickel.

Silver coins are for 10 cents (known as a dime), $\frac{1}{4}$ dollar, $\frac{1}{2}$ dollar and 1 dollar.

Gold coins are 1 dollar, $2\frac{1}{2}$ dollars, 5, 10 and 20 dollars.

You will learn the names of other kinds of money if you look at the stamps which bring letters from foreign countries, or you can find a list of them in the current number of *Whitaker's Almanack*.

In dealing with money you may have to answer such questions as these :—

1. How many threepennybits could be given in exchange for £5 : 11 : 6 ?

$$£5 : 11 : 6$$
$$20$$
$$\overline{}$$

111 shillings.
$$4$$
$$\overline{}$$

446 threepennybits.

2. What sum of money could be paid with 203 half-crowns ?

8)203 half-crowns.
$$\overline{}$$
25£ and 3 half-crowns.

Answer :   £25 : 7 : 6

3. Find the total value of—

francs	centimes	or francs
86	19	86 ·19
539	2	539 ·02
3	25	3 ·25
108	10	108 ·10
736	56	736 ·56

4. What is the change when a 100 dollar bill is used to pay 58 dollars 10 cents ?

$$\$100$$
$$58 ·10$$
$$\overline{}$$
$$41 ·90$$
$$\overline{}$$

EXERCISES.

1. What coins could you use to pay someone 2/3 ?

2. How much money do 3 half-crowns, 2 florins, 8 sixpences make ?

3. Mention any coins whose names occur in your literature study, but which are not in use nowadays.

4. Find out in what countries the following coins are used : rouble, rupee, anna, piastre, ore.

5. Add up £5 : 6 : 8 ; £7 : 13 : 3 ; £10 : 0 : 9 ; £13 : 15 : 2 ; £7 : 18 : 6.

6. Add up 2½ guineas ; 23/9 ; 3/5 ; 3 guineas.

7. Add up 3 fr. 50 ; 7 fr. 25 ; 6 fr. 20 ; 10 fr. 35.

8. What change would you have if you wished to pay $6.75 with a $10 bill ?

BUYING AND SELLING GOODS

In the last chapter we used the word price. Now we must learn some of the ways in which prices are quoted.

If you went to buy a tennis racquet the salesman would perhaps tell you that some of those he had were 14/6 each, and better ones a guinea each or 35/– each—that is, he would quote the price of a single article. But when you wanted shoes the price would be 5/10 per pair—it would be of no use to tell you the price of one shoe.

Then for very small things sometimes it is usual to sell several together—thus marbles may be four a penny, and boot buttons six a penny.

Sometimes prices are quoted for bigger quantities still. If I were buying pencils for the class I might ask for three dozen (a dozen means 12), and if I wanted enough for the whole school I might order two gross (a gross means 144).

Envelopes are sometimes sold at 6¾d. a 100. Could you tell me how much that is each ? No one would ever want to buy only one of that sort of envelope, so this price is quite convenient. But sometimes the price may be quoted in two ways, *e.g.* matches at 1d. a box, or 10¾d. a dozen boxes—it is cheaper to buy several at once if you think you will have occasion to use them.

But things like stamps will never be cheaper bought in quantities—if you buy a book of stamps it is for convenience, not cheapness.

Some goods cannot be sold in ones, or dozens, or hundreds, because of their nature ; some method of measuring them as distinct from counting them had to be·devised.

Ribbons and tapes and string and dress materials are sold by length—usually at so much (say 2/1) per yard in England, and at so much (say 3·50 francs) per metre in France and in many other parts of the world. A metre is a little longer than a yard.

Many kinds of food are sold by weight. You buy sweets at 2d. per ounce, butter at 1/4 per pound, potatoes (in some

parts of the country) at 1/1 per stone ; coal is also sold by weight, at 2/– per hundredweight (say), or, if you have a cellar and can store a quantity, at the cheaper rate of £1 : 17 : 6 per ton. In France most of these goods would be sold by the kilogramme (which is about $2\frac{1}{5}$ lbs.).

It is not always convenient to weigh liquids—it is better to sell them by some other method of measurement—usually by the capacity of the jug or bottle which contains them. Thus you buy a pint of milk for 3d. or a gallon of petrol for 1/3. In France you would buy these things by the litre (about $1\frac{3}{4}$ pints).

When you pay the electric light and power bill you are charged for so many " units of electricity." This is measured neither by length, nor weight, nor capacity, but by a unit of its own. Gas, too, has its own unit, the therm, which is a measure of the amount of heat yielded : the price of gas is not the same in all districts, but is about 6d. or 7d. per therm.

Land is sold by the acre, which is a measurement of area, or in the smaller pieces used for allotments sometimes by the lug. Sheets of glass and planks of wood are also sold according to their area, and the price is quoted per square foot, or per square yard, and abroad at so much per square metre, and the same type of quotations are made about carpets and other floor coverings.

When one person buys several different kinds of things in the same shop the salesman makes out a bill, or invoice, something like this :—

Mrs. A. R. Thomas.

Bought of E. Carter, Grocer.

11*th December*, 1933.

	£	s.	d.
6 lbs. sugar at $2\frac{1}{2}$d. per lb.		1	3
2 doz. matches at $10\frac{3}{4}$d. a dozen ..		1	$9\frac{1}{2}$
3 lbs. butter at 1/5 per lb.		4	3
5 eggs at $2\frac{3}{4}$d. each		1	$1\frac{3}{4}$
		8	$5\frac{1}{4}$

When the goods have been paid for Mr. Carter receipts the bill by writing " Received with thanks " and his name and the date at the bottom. If the total of the bill is more than £2 he must put a 2d. stamp on it and write the receipt across

this. That is part of the law of England—the 2d. paid for the stamp goes to the Government and helps to pay the nation's expenses.

It is also the law that Mrs. Thomas must pay the bill in a convenient form. If she offered Mr. Carter a bag with 101 pennies and a farthing in it he might refuse to accept it, and insist on her fetching silver coins, because coppers are not " legal tender " for large amounts, but he cannot object to receiving four florins and 5¼d. in copper, however much he would prefer eight separate shillings. Silver coins are not legal tender for more than £2.

The same rules of arithmetic would be wanted in keeping a stock book, but it would not be necessary to write so many words because the book is only used by people in the business who know how it is arranged. A few lines of one might look like this :—

	£	s.	d.
1 each at 10/9, 8/11, 5/6, 4/3, 7/10	1	17	3
20 at 12/6	12	10	
13 at 9/–	5	17	
2 at 21/–	2	2	
1 each at 8/–, 11/3, 4/7	1	3	10
	23	10	1

Book-keeping is largely a matter of arrangement. Any clerk must be quick at adding up, and there are certain general rules which he must observe, and then he must learn how the records are to be arranged in the particular business house which he is serving.

If you ever want to find the cost of a large number of articles all at the same price the following arrangement may be useful. It is based on the fact that 396 articles at £1 each cost £396, but 396 articles at 2/– each would only cost $\frac{1}{10}$ of £396.

1. Cost of 418 articles at £3 : 9 : 4 each :—

	£	s.	d.
418 articles @ £3 each	1,254		
418 ,, 8/– (4 florins) each ..	167	4	
418 ,, 1/4 (⅙ of 8/–) each ..	27	17	4
	1,449	1	4

2. Cost of 189 articles at 12/6¾ each :—

	£	s.	d.
189 articles @ 10/– (£½) each	94	10	
189 ,, 2/6 (¼ of 10/–) each ..	23	12	6
189 ,, ¾d. ($\frac{1}{40}$ of 2/6) each ..		11	9¾
	118	14	3¾

This arrangement is called " Practice," and can be practised in school—its value is chiefly that it finds the larger part of the answer first. If you use it you should aim at using as few lines as possible, but do not pretend to use few lines when in reality you have used side-working. *All* the work not shown above was done mentally—there was no side-working done.

You will find it useful to remember the following :—

10/– = £½, 6/8 = £⅓, 5/– = £¼, 4/– = £⅕, 3/4 = £⅙, 2/6 = £⅛, 2/– = £$\frac{1}{10}$, 1/8 = £$\frac{1}{12}$, 1/4 = £$\frac{1}{15}$, 1/3 = £$\frac{1}{16}$, 1/– = £$\frac{1}{20}$, 6d. = £$\frac{1}{40}$.

An even number of shillings can be worked in florins by remembering that 2/– = £·1.

Thus, in example 1 above the cost of 418 articles at 8/– each is £41 ·8 × 4.

You should also notice that :—

A dozen articles at	1d. each cost	1/–
,, ,,	7d. ,, ,,	7/–
,, ,,	¼d. ,, ,,	3d.
A score of articles at	1/– ,, ,,	£1
,, ,,	3d. ,, ,,	5/–

You will be able to think of similar " short cuts."

If you want the price of 50 articles at 19/11½ each, think what 50 articles at £1 each would cost and subtract 50 halfpence.

There is more arithmetic in making out bills and keeping accounts in English money than there is in most other currencies. In any decimal currency (like the French, where 100 centimes make 1 franc) you should always work in decimals.

EXERCISES.

1. How many are a dozen, a score, a gross ? Mention any instance where goods are sold by the score.

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2. How does (a) a smoker, (b) a housewife buy boxes of matches ?

3. Suggest someone who might buy large buttons (a) one at a time, (b) by the dozen, (c) by the gross.

4. Make out a bill for six three-halfpenny pencils, eight sheets of cartridge paper at 2d. a sheet, three dozen drawing pins at 1d. a dozen, 10 nibs at 2 for three-halfpence.

5. Find the sum received for selling 475 railway tickets at £3 : 11 : 7 each.

6. Inquire the prices of coal, potatoes, milk, bread, flour in your district (a) in quantities such as your mother might buy, (b) in quantities such as might be purchased for use at the local hospital.

SELLING OUR SERVICES

In Chapter I it was pointed out that buying and selling began in order to supply people's wants in the way of food and clothing. But as life becomes more complicated other wants arise. For instance, even in the days of exchange and barter, when one man had a couple of sacks of corn and wanted to exchange them for 240 eggs, say five miles away, he would want a horse to carry the loads backwards and forwards. It would not be absolutely necessary for him to own the horse or even to make the journey himself, but if a third man took the corn the five miles, saw the owner of the eggs and gave him the corn, and took the eggs back to the first man, he and his horse would be supplying the wants of the other two men, and perhaps they would give him a basketful of the corn and a dozen of the eggs in exchange for his services. You see this is a new form of buying and selling—the seller is paid for something he does, and the buyer has no goods to show in exchange for the payment.

Modern transport services are very highly organized, and there are several ways of quoting the prices, which are called fares for passenger traffic, and freight charges for the carriage of goods. In estimating the value of the service rendered measurements may be made of the distance—taxi fares are usually so much per mile, or of the time taken—trial flights in an aeroplane are charged at so much for half an hour's trip—or of the speed, as when you send a trunk more cheaply by goods rail than if you require it to travel on an express passenger train. Travellers may also be willing to pay a higher price for extra comforts on the journey, and freight charges may be conditioned by the weight or by the bulkiness of the goods carried, or, if they are very fragile, by the extra care necessary in handling them. People who sell transport services have scales of charges ready worked out for the various classes of goods they carry or for the types of accommodation they

offer to passengers. Thus, on inquiry you will be told at once the cost of a second-class passage to New York, or the charge for sending a case of apples from Taunton to London.

When valuable goods are sent by sea or by air an extra charge is often made for insurance, or passengers can insure against accident in any form of travel. This is paying for something they hope not to have to claim—it is quite separate from the transport charges. The idea is this : if 240 people each send a parcel worth £1 and each pays the transport charge of 1/– and an extra 1d. for insurance, and then one of the parcels gets damaged or lost while the others are all duly delivered, the transport company will be able to pay £1 to the owner of the lost parcel—so what has been ensured is that either the parcel is delivered or its value can be claimed. Of course, the plan does not always work out as easily as in this example—sometimes the company has no accidents and adds the extra payments (sometimes called premiums) to its profits—sometimes it has a great many accidents and has to meet more claims than the premiums paid were expected to cover—but if the goods are insured the company takes these risks, if they are not insured they are carried at owner's risk, and if the parcels are lost he just has to put up with it. Arranging for insurance has become a business in itself, and the men who undertake it are called insurance brokers or, for shipping, underwriters. They usually quote their prices at so much per cent. of the value insured. Other forms of insurance will be referred to in later chapters.

Postal and telegraph and telephone services are somewhat similar to transport services. We do actually pay for something to be carried by the post, and the charges are based partly on weight and partly on political agreements—they do not depend on distance normally, though this does influence the air mail charges to some extent. Telegraph and telephone messages are sent along wires or through the air—no weight is in question. Telegrams are charged for according to the number of words, telephone users pay partly for the convenience of having the receiver fixed in their homes (say 2/6 a week) and partly according to the number of calls (1d. per call) they send out—for trunk calls the charges depend on the distance and on the time the conversation lasts.

But transport and communications are not the only types of services which are bought and sold. Indeed, it is by selling

their services that the majority of people in civilized countries nowadays provide for their wants. They do not grow their own food and make their own clothes—instead they agree to spend their lives doing some particular form of work, and in return they are given money with which they buy the food and clothing and other things necessary to supply their own wants.

There are various ways of deciding how much money shall be paid for the work done. One way is to determine what wants the worker will have to supply. This is what is meant by paying " a living wage "—it makes no attempt to value or measure the work done, but considers only the worker.

Another way is to consider how long the worker is employed, so that wages are paid at so much per hour, or per day, or per week. Except that if a man or a woman proves very slow he or she is likely to be displaced by someone else, this method takes no account of either the value of the work or in reality of the needs of the worker, unless it is coupled with some guarantee of the number of hours or days to be spent on the work. But it is the usual method for such work as loading a ship, sweeping the streets, and to reward woodworkers in a shipyard.

Still another method is what is called " piece-work." This is an attempt to measure achievement. Garment workers are paid for every buttonhole made, home knitters are paid as and when the work is completed, envelope addressers charge so much per 1,000, riveters in a shipyard are paid according to the number of rivets inserted. Other examples could of course be quoted, but in this country piece-work is now usually modified to prevent sweated labour ; under the Trades Boards Act tests are made to find out how much work it is reasonable to expect workers to accomplish if they work steadily, and the rates of pay are fixed so that even the slow workers obtain enough to live on and the quick workers are rewarded for their quickness by being paid more. Thus a woman working 40 hours in a week at making buttonholes must receive 26/8, but if she makes more than 640 buttonholes she may receive ½d. each for the extra ones.

Some forms of achievement cannot be measured by the " piece." Salesmen and shop assistants are very often paid on a commission basis. This means that each receives usually

a certain minimum payment, say £1 a week, and then a record is kept of what each assistant sells in that time. Let us suppose one sells £40 worth of goods, and is to receive commission at $2\frac{1}{2}\%$. She will then earn $£1 + £\left(\frac{2\frac{1}{2}}{100} \times 40\right)$, *i.e.* £2 in all.

Another form of payment which depends on work actually done consists of the fees charged by lawyers and doctors and dentists. For instance, the dentist may charge 7/6 every time you visit him, with perhaps the cost of the stopping he puts in your tooth. If 50 people visit him in a week he earns over £18; on the other hand, if only 4 people consult him he has to be content with 30/–.

The fees are sometimes fixed to suit the people who are likely to come as patients—thus if the dentist lives among folk who earn a weekly wage in a factory he may charge at a lower rate than if he lives near the large hotels and boarding houses of a seaside town; but if his fees are low he must see his patients more quickly, and perhaps have a less comfortable surgery, for he must earn enough to supply his own wants. Panel doctors are paid according to the number of people on their panel, or list, whether these people consult them many times or few. The dentist at a school clinic is paid a salary by the Local Education Authority, and the fees, if there are any, paid by the children's parents go to the Authority, not direct to the dentist. It takes 160 sixpenny fees to make up £4, so no wonder the children have to go very quickly one after the other.

In some professions a salary is paid at the rate of so much a year, and the employee has to do whatever work there is to do. Some days he may be kept very busy, at other times he is almost unoccupied, but this makes no difference to his pay. Bank clerks, civil servants, and municipal officials are paid in this way, and so are indoor domestic servants. What the salary is to be is determined neither by the amount of work nor by the wants of the worker, but by the qualifications necessary to obtain the post and by the responsibility attached to it. In general, the salary is fixed before the work is entered upon, and is unaffected by whether the employee proves good at it. If the employer wishes later to recognize some particularly good bit of work he pays a bonus, but this is a gift and not to be counted on regularly.

If the work includes personal service for someone other

than the employer, and this outsider wishes to add to the employee's emoluments, he gives a tip.

Occasionally someone who has undertaken work for which it was not intended that he should be paid is afterwards rewarded by a payment. This is called an "honorarium."

Perhaps you have heard of salary scales. This is a system by which the rate of salary is increased at regular intervals. For example, on one scale the minimum is £216 and the annual increment £12, but there is no increment for the first year, so an employee of six years' service would receive £276 per annum in the seventh year.

It was stated in Chapter I that the price of anything must be agreed on between two people. In the fixing of wages and salaries, however, there has grown up the practice of collective bargaining, so that all bricklayers, for instance, have their pay calculated in the same way, agreed on between a few representatives of the builders and of the bricklayers. Similar committees to settle rates of pay exist in other trades and professions.

EXERCISES.

1. The single fare for a journey is 17/8. A summer ticket is issued offering the return journey for a single fare and a third. What does this cost ? If this is equivalent to travelling at 1d. a mile, what will it cost to take your bicycle with you at 6d. for every 25 miles or fraction thereof ?

2. Find the postal charges for 10 newspapers going to different parts of the British Isles, 3 postcards to places in Europe, a letter by air mail to Delhi, India, and a parcel weighing 3 lbs. addressed to Melbourne.

3. Calculate the rate of salary in the year 1933–34 for a worker employed continuously since September, 1925, if the minimum of her scale is £150 and the increment £9 per annum. No increment is allowed for the first year, but she now has an annual allowance of £15 for extra duties.

4. Mention people in your own district who sell their services (a) by the hour, (b) by doing "piece-work," (c) for a salary, (d) by charging fees, (e) on commission.

5. Find out whether 20 lbs. of apples intended as a present for a friend in London could be more cheaply sent by passenger

rail, or by being packed in two or three parcels for the post. [If you live in London consider that the present is to be despatched from Taunton.]

6. A salesman is engaged at 36/– per week, with 10% commission on sales. What does he earn in three weeks if he sells £23, £28 and £31 worth of goods ? Would he have been better off with 15% commission and no salary ?

PAYING FOR THE USE OF SOMETHING WITHOUT BUYING IT

If you lend your bicycle to a friend, who rides 50 miles on it and then brings it back to you looking perhaps a trifle dusty but otherwise much as it did before, you know that although it looks unaltered, its tyres and joints have been worn, and that 50 miles' ride has brought the time when you will want new tyres and screws nearer. If you are not a rich person you will appreciate it if your friend offers you half-a-crown to put by ready for those new tyres when they are wanted, *i.e.* he pays for using the bicycle, although he does not buy it. If you had agreed beforehand that he should pay this half-a-crown the arrangement would not have been " buying and selling," but " letting and hiring "—you let out your bicycle on hire.

This is a simple example of a very common practice. Generally hire terms depend on time. You hire a room for an evening meeting, or a bathing tent for a month while you are at the sea, or the gas company lets a stove for 3/– a quarter. In this case, as long as you are using the stove you pay 3/– every quarter—when you cease to do so the company takes the stove away.

In the same way the house you live in may not be your own. It has been let to you by the owner, and you pay rent for it. Rent is the word used for the hire-charge for a house, and sometimes for other things, but not usually when the let is only for a few hours—thus it is customary to rent the rooms for your holiday, but to hire a boat for a trip down the river.

Even if you own your house, you may have to pay ground rent for the land on which it is built. If a man owns land or houses which he cannot use himself he usually lets them—it is to his advantage to do so, as it provides him with money to supply his needs, coming to him as regularly as if he had sold

his labour.   Money received in this way is sometimes called
unearned income.

It happens sometimes that a man has saved a sum of
money—say £200—which he will not want immediately, but
he does not wish to buy land with it because if he does the
money will not be available when he does want it.   At the same
time he thinks it a pity that it should lie idle, so he lends it to
a body of people who do banking (see Chapter X).   The bank
agrees to pay him £5 every year as long as they hold the money
and to return him the £200 when he wants it.   Quite possibly
they do use it to buy land, but as banking is their business,
when the lender asks for £200 they will just have received
this amount from someone else.   A " run on a bank " means
that everyone asks for his money at once, and this puts the
bank into difficulties, such as some banks were in in Germany
in the summer of 1931—there is a vivid description of how such
a run was stopped in *John Halifax, Gentleman*—but usually
people trust the banks and business goes on quietly.

What I have described is an easy example of Simple
Interest.   The Principal was £200 and the rate $2\frac{1}{2}\%$ per
annum.

Here is a harder example.   A man invested (lent) £732
at $3\frac{1}{4}\%$ per annum and reclaimed it in 5 months : how much
did he receive as interest ?

Think as follows :—

Interest on £100 for 1 year is $£3\frac{1}{4}$

$$,, \quad ,, \quad ,, \quad ,, \ \tfrac{5}{12} \quad ,, \quad ,, \ £3\tfrac{1}{4} \times \tfrac{5}{12}$$

$$,, \quad ,, \ £732 \ ,, \ \tfrac{5}{12} \quad ,, \quad ,, \ £3\tfrac{1}{4} \times \tfrac{5}{12} \times \tfrac{732}{100}$$

$$= £\frac{13 \times 5 \times 732}{4 \times 12 \times 100}$$

$$= £\frac{2379}{240}$$

$$= £9 : 18 : 3$$

The £732 was also repaid, so he would then have an amount
of £741 : 18 : 3.   In work on interest the word " amount "
is always used thus, to mean the sum of the principal and the
interest.

Now consider the general problem—find the interest and amount of £P invested at r% per annum for t years.

Interest on £100 for 1 year   is £r.

,,   ,,   £100   ,, t years ,, £r × t.

,,   ,,   £P   ,, t   ,,   ,, £r × t × $\dfrac{P}{100}$

This is usually quoted in the form £I = £$\dfrac{Prt}{100}$

The amount is then £P + £$\dfrac{Prt}{100}$

Of course, if P francs had been invested the interest would have been $\dfrac{Prt}{100}$ francs.

Notice that t is measured in years.   Very often the interest in a business transaction is only for a period of days, say from 12th June to 28th September.   If the Principal is \$352·8 and the rate 4·5% per annum the interest can then be worked as follows :—

		days
June 12th–30th	.. ..	18
July ..	.. ..	31
August	.. ..	31
September 1st–28th (inclusive) ..	..	28
		108

$\$I = \$\dfrac{352\cdot8 \times 4\cdot5 \times 108}{100 \ \times 365}$

$= \$\dfrac{3\cdot528 \times 486}{365}$

$= \$4\cdot70$

The amount is then \$357·50.

$$
\begin{array}{r}
3\cdot528 \\
486 \\
\hline
1411\cdot2 \\
282\cdot24 \\
21\cdot168 \\
\hline
365)\overline{1714\cdot608}(4\cdot69(7) \\
254\cdot6 \\
35\cdot60 \\
2\cdot75
\end{array}
$$

Of course, if you want to lend your money at interest you are not obliged to go to a bank.   You can make a private arrangement with a friend whom you want to help, or you

can try to find someone who will promise a high rate of interest. Often if the rate of interest is high it is very difficult to get back the principal when you want it—banks do not pay such high rates, but are much less risky. Moneylenders make a business of lending to people who will promise a high rate of interest because they are badly in need of the money. Lending for the sake of the interest, and not because you want to help the borrower, is lending upon usury.

It is sometimes useful to notice that the formula—

$$I = \frac{Prt}{100}$$

can also be written in the following forms :—

$$P = \frac{100\,I}{rt}$$

$$r = \frac{100\,I}{Pt}$$

$$t = \frac{100\,I}{Pr}$$

These can be used in dealing with problems where the Interest is known and one of the other quantities, *e.g.* the Principal, has to be found, but in practical affairs it is only useful for small values of *t*.

You should also notice the following :—

What sum of money invested now at 4% per annum Simple Interest will amount to £315 in 3 years ? [Again notice that such a problem much more often occurs with a short period of less than a year, but the method of dealing with it is the same.]

£100 invested now will amount to £112 in 3 years at 4%.

$\therefore$ the sum required is $\frac{100}{112}$ of £315 = £281 : 5 : 0.

This is sometimes called the Present Value of £315 due 3 years hence.

Check. Interest on £281 : 5 : 0 at 4% for 3 years

is $£\dfrac{281\frac{1}{4} \times 4 \times 3}{100} = £\dfrac{1125 \times 4 \times 3}{4 \times 100} = £\dfrac{135}{4} = £33 : 15 : 0.$

$\therefore$ Amount is £315 : 0 : 0 as required.

You will find more about banking and interest customs in later chapters of the book. One very important thing to

remember is that interest has to be paid every year (or every half year)—the longer the borrower keeps the principal the more interest he has to pay ; if he keeps it a long time he may actually pay more in interest than he originally borrowed, but he still owes the principal even in this case.

For example, if £100 is borrowed at 5% and kept 30 years the interest is £150, which has been paid £5 at a time. To get out of debt the borrower has still to pay £100 in one sum, and after that he will cease paying interest.

I mention this because there has of late years grown up the hire-purchase system, which is best explained by an example. Suppose you want a piano. To buy one would cost £50. To hire one would cost £1 a month. You have the piano delivered at your house and you agree to pay the shopkeeper £5 every month for 12 months. Then you have paid him in all £60 and the piano is yours. It has cost you more than if you had paid for it when you bought it because you have been paying a hire-charge all the year, but you had the use of it before you had saved up enough money to buy it. Most furniture can be bought in this way, and so can houses, and even clothes. You have no doubt seen advertisements for furnishing out of income. The system has advantages, but you should remember that it has also drawbacks in that it pledges your money in advance.

EXERCISES.

1. An employer lends a workman £10 and arranges to receive 2d. a week as interest. The workman sets aside 2/– a week to repay the debt. How much interest will he pay in all ? If instead of being collected every week the interest due had been paid at the end of a year, to what rate per cent. per annum is it equivalent ?

2. How much interest would be due on 30th June, 1933, on £57 : 12 : 0 deposited in the bank on 25th March, 1933, at 3% per annum ?

3. (Harder.) What is the value on 1st December, 1933, of £100 due on 30th April, 1934, reckoning interest at $3\frac{1}{2}$% per annum ?

4. What is the half-yearly interest to be paid on a sum of £475 borrowed at $4\frac{1}{4}$% per annum ?

5. A householder pays 17/6 per quarter for the hire of a gas cooker. To buy a new one outright would cost £10 : 10 : 0. How many years' rent would pay for the new one ? What would you suggest as a fair hire-purchase charge per quarter for a period of three years ?

6. A refrigerator can be bought for £19 : 10 : 0 or 24 monthly payments of £1 : 0 : 0. A larger model costs 33 guineas or 24 monthly payments of £1 : 11 : 9. What is the hire-charge per month in each case ? Does your answer seem to you to require comment ?

7. Will the income from £290 invested at $4\frac{1}{2}\%$ pay the rent of a cottage at 5/- a week ? What would you expect such a cottage to cost to buy (*a*) outright, (*b*) on a hire-purchase basis with weekly payments spread over 15 years ? Find an advertisement for a house to be bought by instalments, and see whether your suggestion compares reasonably with it.

COMMUNITY EXPENSES

WHEN men live in communities they have certain wants in common, additional to the wants of each individual. From the palisade round a collection of mud-huts to an elaborate system of street lighting by electricity, these must be secured by joint effort. In modern England there are in general three ways in which each individual contributes to community expenses :—

1. By paying rates to the Rating Authority for local Government, which may be administered by a County Council, a Borough Council, or an Urban District Council.

2. By paying taxes either indirectly or directly to a Government Department for National purposes.

3. By voluntary subscriptions and service to Church or Chapel or Hospital or other organized activity, including sports and recreational clubs.

The customs in connection with the first two categories require some arithmetical knowledge.

It is important to remember that a Local Government Council consists of representatives of the community served, and has no resources apart from the community. It is the trustee of Corporate Property which may have accumulated in the course of years, such as the Guildhall, the water reservoir, the electric light plant, and if it administers these well it may arrange that they pay for themselves; but to supply other wants like the care of the sick and poor, the cleansing of the streets, the provision of a police force, and of schools and teachers whose services shall be free to all children, money must be collected from the members of the community.

The system is that all land and houses in the area are valued or assessed, and the total of all such assessments is the " rateable value " of the district. Then the Council each year (or half year) makes an estimate of how much money will be required for the purposes of local government in the coming year (or half-year). If the rateable value were £500,000 and

the estimated expenditure were just half this, the rate would be 10/– in the £. Suppose the rateable value is £556,288 and the Council estimates that £274,370 will be required during the year.

$$\text{Work out } \frac{274,370}{556,288} \text{ of } £1$$

$$= 9/10\tfrac{1}{2} \text{ (nearly)}$$

The Council might then declare a rate of 9/11 in the £. This would mean that a man living in a house assessed at £40 would have to pay 40 times 9/11 or £19 : 16 : 8 in rates that year. The next year the rate might be 9/9 in the £, and another year 10/1 : a new rate is declared each year. If the rate goes up or down a penny, it will make a difference of 3/4 to the man with the £40 house, and of $£\dfrac{556,288}{240} = £2,318$ (nearly) to the whole community. This is sometimes expressed by saying that £2,318 is the product of a penny rate in that area. The yield will not, however, be quite as great as this, as there are sure to be some unoccupied houses on which no rates are paid.

When people live in small houses, or in part of a house, for which they pay rent weekly, it is customary for the landlord to include a contribution to the rates in the rent charged, *e.g.* a weekly payment of 12/6 may include 5/– for rates, and will perhaps go up 1d. when a new year begins. This practice is a convenience both to the tenant, who would otherwise have to pay a much larger sum at the end of the quarter, and to the rating authority, as the officials receive the rates for a dozen or more houses together, instead of having to collect them separately. But it has disadvantages in that the tenants are apt not to realize their responsibilities as rate-paying members of the community.

But we all owe duties not only to the town or county in which we live, but to the country as a whole. The Post Office, the Naval Dockyards, the B.B.C., and other institutions like the Tower of London, are the property of the whole nation. The representatives of the nation in Parliament and the Government are the trustees of national property, and are entitled to call on the nation for money to carry out the nation's work. But they have a much more difficult task than the local council, because their annual budget has not only to estimate how much money will be required, but to devise

ways of raising this money, *i.e.* to impose taxes. In local government all the money necessary is obtained by rates, which depend on land and houses, but taxes may be levied on any kind of property. The most usual forms of direct taxation are :

(*a*) Income tax, quoted at so much in the £ on annual income.

(*b*) Estate duty and legacy duty, quoted at so much per cent. of the value of the estate or legacy.

(*c*) Licences, *e.g.* dog licences, 7/6 per dog ; motor car licences, 15/– per horse power ; driving licences, 5/– per driver.

(*d*) Stamp duties on cheques and receipts and on various legal and business papers.

These are direct, because the person paying them realizes that he is contributing to the Exchequer funds. (The Exchequer is the Government money office.)

But many members of the community are indirect tax-payers through Customs and Excise duties. These are taxes imposed in bulk on such articles as beer, tobacco, tea, sugar, silk goods, when they leave the ports or the factories—are " taken out of bond " is the expression used—but they affect the prices charged for small quantities of these goods in the shops, just as the rates paid by the landlord affect the inclusive weekly rents. Entertainment taxes come also under the heading of excise duties. There are, of course, many people in the country whose only contribution to the national expenses is made in this indirect way, and these are sometimes apt to lose sight of their responsibilities. At one time there was a poll tax in the country, *i.e.* every person had to pay some small sum direct to the Exchequer, but it is a couple of centuries since such a tax was levied in England. Of course, Parliament might re-impose it at any time, though it is very unlikely that this will happen.

Unless you become a Civil Service clerk, or a clerk in some business house or solicitor's office where one of these taxes is dealt with, you will not have much arithmetical concern with most of them, but the income tax law is complicated and is worth further study. You should remember, of course, that Parliament may modify it at any time, and the figures quoted may be out of date when you read this book, but the ideas are fairly well established.

Income tax is a tax on income, *i.e.* on all the money which comes in to an individual during the year. When asked for

C

an income tax return you must be careful to state all the money you have received during the year in question—at any rate, all that comes at all regularly—there are a few exceptions, *e.g.* if you sell your house the money received is not income, and presents from your friends need not always be declared, but all the income you can count on must be.

Income is of two kinds : earned income, received as wages or salary, or the profits of your own business ; and unearned income, consisting of interest on money invested or rent from houses or lands which belong to you.

There is a standard rate of tax, say 5/- in the £, but only people with large incomes really pay at this rate. On the first £100 of your income you pay nothing at all. In addition you pay no tax on one-fifth of your earned income, *i.e.* if you earn £200 a year you pay no tax on £100+£40, and your taxable income is £60. On this you pay tax at half the standard rate, so your tax for the year is 60 half-crowns or £7 : 10, which is usually collected in two instalments, not necessarily equal. This half-rate applies to the first £175 of taxable income. If your income is all unearned and amounts to £275 per annum you are liable for 175 half-crowns, or £21 : 17 : 6d.

As a matter of practice, however, very often unearned income is taxed at source at the standard rate. This means that the Government authorizes the banks not to pay over to the individual all the interest due to them, but to deduct the tax and send it to the Exchequer. So the person whose income we imagined to be £275 may only have received £206 : 5 : 0 in an extreme case, and £68 : 15 : 0 has been sent to the Government on his behalf. But he is only liable for £21 : 17 : 6, and can put in a claim to have £46 : 17 : 6 refunded to him.

Let us now consider a less straightforward case. Someone has an earned income of £3 a week or £156 per annum, and also is entitled to £45 as unearned income, of which £20 is taxed at source. Calculate the tax due, if any.

Total income ..	..	..	..	£201
Allowances	..	..	..	⎰ £100
			+	⎱ 31 : 4 : 0
Taxable income	..	..	..	69 : 16 : 0
Tax due at half standard rate		..		8 : 14 : 6
Tax already paid	..	..	..	5 : 0 : 0
Tax still due ..	..	..	..	3 : 14 : 6

A married man is required to include his own and his wife's income on one return, but £150 of this joint income is not liable to tax, and if they have children a still larger sum is allowed to go tax free. In certain circumstances, however, husband and wife may be separately assessed if they desire it.

A couple with an income of £800 a year, of which £500 is earned by the husband, would calculate their tax thus :—

Total income	£800	
Allowances	⎰ £150	(Man and wife.)
+	⎱ £100	(One-fifth of earned income.)
Taxable income ..	550	
Tax on £175 at 2/6 ..	21 : 17 : 6	
Tax on £375 at 5/– ..	93 : 15 : 0	
Total tax	115 : 12 : 6	

Some people with very large incomes pay super-tax. This means that they pay part of the tax at half the standard rate, part at the standard rate as above, and part at a still higher rate. Details of this are not necessary while you are at school.

In modern England provision for old age, for a man's dependants after his death, and for periods of sickness and unemployment is encouraged, and is in some cases compulsory. In Chapter III the meaning of insurance against accidents of travel was explained. There is another form of insurance known as life insurance. Of course, no one can be insured against death, which must come to everyone sooner or later, but a system has grown up by which if a man pays an annual sum of money (a premium) to an assurance society, this society undertakes to pay a much larger sum to his relatives when he dies, *e.g.* a man aged 27 and in good health insures his life for £1,000. The company charges an annual premium of £24 approximately. If the man dies before he is 68 the company may lose in this case ; if he lives till he is 75 the company makes a clear profit. Of course, the company may invest the money till it is wanted and so obtain interest and reduce the risk of loss. This system is encouraged by our Government by allowing the part of a man's income which pays his life insurance premium to be tax free, or taxed at a lower rate than it would be if he had used it in any other way.

A somewhat similar arrangement can be made with an insurance company to provide for old age. By paying an annual premium one can insure that a sum of money shall be available when one reaches 60 or other age. Such premiums, too, are in some cases tax free, but provision for old age among police, teachers and other civil servants of the Government is arranged by contributory superannuation schemes. This means that a part of each employee's salary is withheld, to form, with some of the revenue, a fund from which pensions to retired employees can be paid.

In addition, we have compulsory insurance against sickness and unemployment for certain classes of weekly wage-earners in this country. Each such wage-earner, *e.g.* a domestic servant, must pay 6d. every week out of her wages when she is in good health, her employer must pay 7d. and the revenue supplies another 4d. These contributions together make a fund out of which the panel doctors are paid, and the remainder of which can be used to pay the worker a weekly sum when she is ill and cannot earn her wage. Of course, if very few people are ill the money remains in the fund, if a great many people are ill it may be difficult to make the weekly payments, and it might be necessary to increase the contributions from those who are well. They are not as low now as when the scheme was started. This plan was only begun in 1912, but in 1928 industrial pensions were added to the scheme, *i.e.* insured people of 65 or over can draw a weekly payment whether they are well or ill.

Unemployment insurance is a similar but separate scheme. A man in an insured trade pays 10d. a week when he is employed, his employer adds 10d., and the revenue provides another 10d. From the fund thus formed the unemployed receive weekly benefits. When this fund was started the enormous volume of unemployment in the post-war years was not foreseen, and so the fund proved quite inadequate for the demands made upon it. In 1931 the contributions (or premiums) were raised, and the benefits lowered, but even so the fund is still deeply in debt.

As these insurances are compulsory the premiums are a form of taxation of the employers : they are only really insurances from the point of view of the workpeople, for whom the State acts as an Insurance Company and takes the risk of losing money if large numbers are ill or unemployed, and

of making a profit if the nation is healthy and working. But
the day when the insurance departments will prove a source of
revenue is far distant ! If it ever did dawn either the benefits
would be increased or the contributions lowered—the money
would not be used to finance other departments.

EXERCISES.

1. Find out the rateable value of your district, and work
for yourself what would be the product of 1d. rate. What
difference would 1d. rise in the rates make to the tenant of
the house in which you live ? [Give the result weekly or
quarterly or yearly according to the way in which the rates are
paid.]

2. Examine a rate paper or find out otherwise how the
rates of your district are used. How much of the general rate
goes to (*a*) water supply, (*b*) education, (*c*) poor relief, (*d*) some
other department in which you are interested ?

3. What rate will be declared if a town has a rateable
value of £974,216 and the Corporation is estimating for an
expenditure of £710,358 ? What will be the demand made on
a man owning a house rated at £38 ?

4. Work out the income tax payable by a man earning
£250 a year, with a wife and two children, if he also receives
£25 as the rent of a house, and £15 net from an investment
taxed at source.

5. A woman pays 2/4 every four weeks into an insurance
society. This entitles her to 7/6 a week in case of illness, but
she must keep up her payments. If she is ill for 9 weeks two
years after she joined the society has she paid for all her
sickness benefit herself ?

6. What rate in the £ on his whole income was each of
the tax-payers mentioned on pages 34 and 35 contributing
to the Exchequer ?

7. Find out the rates of tax and of allowances now in
force and work the examples on pages 34 and 35 for the current
tax-year. (April 5th—April 5th.)

COMMUNITY FINANCE CONTINUED

IT has been emphasized in the last chapter that the budget for each year should balance—that the amount of revenue from the taxes should be sufficient to meet the expenses of the year. In the past, however, there have been occasions, notably when the country has been at war, when expenditure has suddenly outrun revenue, and recourse has been had to borrowing. In new countries money is often obtained in this way for development purposes, such as making roads and railways. Such a loan has recently been issued by the Government of Uganda.

If the Government borrows the nation has to pay interest, which means that the revenue has to be increased—this is what is meant by saying that we are still paying for the wars of the past—or that money has to be provided from taxes for the service of the debt. The British National Debt at present amounts to thousands of millions of pounds, and several hundred million pounds have to be provided every year to pay the interest, to say nothing of attempts to reduce the debt by paying back part of the principal. Of course, this enormous sum was not all borrowed at once, or all from one lender—the Government has thousands of creditors for large and small amounts, many of whom are themselves taxpayers, so that in a sense they provide the interest on their own money.

When the Government decides to borrow money a prospectus is issued stating at what rate per cent. interest will be paid, on what dates it will be paid, how many years it is likely to be before there is a chance of paying back the principal, and any other necessary details—then people who are willing to lend money on these terms offer it through the banks. More may be offered than is required, but in exchange for each sum that is accepted the Government issues a Certificate, sometimes called a Stock Certificate, sometimes a Bond (which it is to

be will be one of the details in the prospectus ; the name
makes no difference to the arithmetic involved).

In any daily paper you can see the names of various
issues of Government Stock Certificates and Bonds—examples
are War Loan 5%, Consols $2\frac{1}{2}$% (short for consolidated funds
$2\frac{1}{2}$%), Victory Bonds 4%, Conversion Loan $4\frac{1}{2}$%, 1940–1944.
The above are some of the British issues, but other Governments
have also borrowed money and issued certificates, such as
French 5% Rentes, Greek 6% Stabilization Loan 1928, Belgian
3% 1914.

Here is an example of the arithmetic in connection with
such certificates.

A man possesses £605 : 7 : 4 of $2\frac{1}{2}$% Consols. What will
he receive half-yearly if income tax at 4/6 in the £ is deducted
at source ?

4/6 in the £ is equivalent to $5/7\frac{1}{2}$ on £1 : 5

$\therefore$ his net dividend (or interest) will be $19/4\frac{1}{2}$ per £100 stock.
So on £605·3̇6̇ he will receive £5 : 17 : 4.

Working.   ·96̇8̇7̇5̇
                     6 ·0536
                  ─────────────
                  5 ·8125
                    504
                     29
                      5
                  ─────────────
                  5 ·8663

£605 : 7 : 4 is the principal. In this connection it can be
called the stock or capital value of the certificate. Other
names for it are the face value, the nominal value or the par
value.

It is important to be able to recognize these names, as you
will see from what follows.

It was pointed out (p. 28) that when money was lent,
otherwise than to a bank, it was sometimes difficult to obtain
repayment of the principal when it was required. Obviously
this is so when the Government borrows and uses money, as
only taxation can supply the sum necessary to repay the
loan, and this cannot be arbitrarily imposed just to suit the

lender. So the custom has grown up of allowing the buying
and selling of stock certificates, and it is done so frequently
that there is a large body of men engaged in arranging such
sales every day. Their business is on the Stock Exchange,
and they are known as Stockbrokers. (There are others with
slightly different functions known as stockjobbers.) The
French Stock Exchange is called the Paris Bourse ; there is
also a Berlin Bourse, and others. Similar business in America
is done in Wall Street.

As with other things which can be bought and sold, the
price of a stock certificate must be agreed on between the buyer
and seller on any particular occasion, and need not remain
the same for any length of time. Thus a War Loan Certificate
with face value £100 may be sold at different times for £95,
£96¼, £98, £99½, £102, £103¾, or any other sum. As a matter
of fact 5% War Loan was originally issued at 95—this means
that for every £95 actually received by the Government a 5%
£100 certificate was issued, *i.e.* the Government undertook to
pay £5 interest every year until it redeemed the certificate by
paying £100 for it. Suppose Mr. Jones sent the original £95,
and gave the certificate to his daughter Mrs. Smith ; she received
the interest as long as she owned the certificate, but there came
a time when she was badly in need of money, so she sold it for
£96 to Mr. Brown. With the certificate she sold her right to the
interest, which was next paid to Mr. Brown. A year or two
later Mr. Brown saw his chance and sold the certificate to
Miss Black for £104 : 15 : 0. Miss Black still possessed it in
1932, and received the interest regularly, but was rather
concerned in the early part of that year because she read in
the paper that other certificates like it were being sold for £94
only. Still, she knew that if she could manage to keep it
till the Government redeemed it she would receive £100 for it
as originally promised.

In quoting the market price of stock it is usual to express it
as a percentage of the face value, but as lists of these prices
are intended for people who understand them, the percentage
marks are rarely inserted. Thus you will become familiar
with such statements as Australian 5 per cents. were at 82,
or German 7 per cents. were at 73½, and you will understand
that an Australian £100 certificate bearing interest at 5%
could be bought for £82 or a German certificate for 100 reichs-
marks with interest at 7% cost 73½ reichsmarks.

Here is an extract from a newspaper for you to study :—

BRITISH FUNDS, ETC.

Consols 2½%	..	.. 80 $\frac{9}{16}$	Conv. 5% 1944–64		.. 119 $\frac{1}{16}$
War 3½% ..	..	.. 104$\frac{3}{4}$	3% 1948–53	..	.. 101$\frac{3}{8}$
Funding 4%	..	.. 115$\frac{3}{8}$	Consols 4%	..	.. 112 $\frac{5}{16}$
3%	..	.. 99$\frac{1}{8}$	Treas. 3% 1933–42		.. 102 $\frac{11}{16}$
Victory 4%	..	.. 112$\frac{1}{2}$	2½% 1937	..	.. 102 $\frac{15}{16}$
Conv. 3½%	..	.. 104 $\frac{15}{16}$	2% 1935–38		.. 100 $\frac{7}{16}$
2½% 1944–49 ..		.. 97$\frac{7}{8}$	Irish Land 2¾%	..	.. 84
4½% 1940–44 ..		.. 110 $\frac{13}{16}$			

COLONIAL GOVERNMENT SECURITIES.

Aus. 5%	1935–45	.. 102$\frac{1}{4}$	Aus. 3½%	1954–59	.. 97$\frac{5}{8}$
5%	1945–75	.. 107$\frac{1}{2}$	Can. 3½%	1920–50	.. 100$\frac{1}{2}$
4%	1955–70	.. 105	4% Stk.	1940–60	.. 105$\frac{1}{4}$
4%	1943–48	.. 101$\frac{5}{8}$	4% „	1953–58	.. 106$\frac{7}{8}$
3¾%	1948–53	.. 100$\frac{1}{4}$	Ceylon 6%	1936–51	.. 106$\frac{3}{4}$
3¾%	1946–49	.. 99$\frac{3}{8}$	Kenya 5%	1948–58	.. 115

FOREIGN GOVERNMENT BONDS.

Prices 13th August, 1934.

Arg. Cons. Tst. 4% " A "	105$\frac{1}{4}$		Brazilian 4%	1889	.. 18$\frac{3}{4}$
5½% " B "	..	.. 109	5% Funding	..	.. 96
3% Max. " C "	..	.. 69	4% Rescission ..		.. 18$\frac{3}{4}$
Arg. 4% 1897–8–9–1900	84		5% Funding 1914		.. 77$\frac{1}{2}$
4% Resc.	..	.. 97	6½%	1927	.. 38
Austrian 6%	..	.. 101$\frac{1}{2}$	Bulgarian 7%	1926	.. 23$\frac{1}{2}$
7% Sterling	1930	.. 71	Chilean 7½%	1922	.. 19
Belgian 3%	1914	.. 98$\frac{3}{4}$	Chinese 4½%	1898	.. 102$\frac{1}{2}$
7%	1926	.. 109$\frac{1}{4}$			

Colonial Governments and sometimes foreign Governments can float their loans (or borrow their money) in London or in other big centres, *i.e.* they need not borrow from their own taxpayers. The Uganda Loan previously referred to was issued in London at 96 and is a 5% Stock.

Thus, when someone finds himself with money to invest he need not lend it direct to a banker or a Government—he can buy Stock Certificates or Bonds with it, and thus become entitled to the interest paid by the original borrower.

Examples.

1. A man invests £55 in 4% Consols at 84¼. What will be the face value of the Certificate purchased ?

An investment of £84¼ secures Stock value £100

$$\text{,,} \qquad \text{,,} \qquad \text{£55} \qquad \text{,,} \qquad \text{,,} \qquad \text{£100} \times \frac{55}{84\frac{1}{4}}$$

$$= \text{£100} \times 55 \times \frac{4}{337}$$

$$= \text{£} \frac{22000}{337}$$

$$= \text{£65 : 5 : 7}$$

$$
\begin{array}{r}
65{\cdot}28 \\
\hline
337)22000 \\
1780 \\
950 \\
2760 \\
64
\end{array}
$$

The face value of the Certificate is £65 : 5 : 7.

The annual interest or income is 4% of £65 : 5 : 7

2.   A man wishes to buy £600 of India 4½% at 75¼. What will it cost him ?

£100 stock costs £75¼.

£600   ,,   ,,   £451 : 10 : 0

The annual interest or income in this case is 4½% of £600.

3.   The owner of \$8,500 Liberty 4½% Bonds sells them at 102$\frac{13}{16}$. What sum does he receive ?

$$\$102\tfrac{13}{16} \times 85 \;=\; \$8739.06$$

$$
\left[
\begin{array}{r}
8500 \\
+ \;\; 170 \\
+ \quad 69{\cdot}06 \\
\hline
8739{\cdot}06
\end{array}
\right]
$$

4.   What annual income would be obtained by investing 10,000 francs in 3% Rentes at 80.20 ?

$$\frac{10,000 \times 3}{80 \cdot 20} \text{ francs} = 374 \cdot 06 \text{ francs.}$$

$$
\begin{array}{r}
374 \cdot 06 \\
\hline
4 \cdot 01)1500 \\
2970 \\
1630 \\
\cdot \;\; 2600
\end{array}
$$

5.   An investor is considering the merits of a $3\frac{1}{2}\%$ Loan at $75\frac{1}{2}$ and a $4\frac{1}{2}\%$ one at $95\frac{1}{2}$. Which yields the larger income on the suggested investment ?

£$75\frac{1}{2}$ invested in the first loan yields £$3\frac{1}{2}$ income.

$$£(75\tfrac{1}{2}\times95\tfrac{1}{2}) \quad ,, \quad ,, \quad ,, \quad ,, \quad £\frac{7}{2}\times95\tfrac{1}{2}$$

$$=£\frac{7\times191}{4}=£\frac{1337}{4}=£334\tfrac{1}{4}$$

£$95\frac{1}{2}$ invested in the second loan yields £$4\frac{1}{2}$.

$$(£95\tfrac{1}{2}\times75\tfrac{1}{2}) \quad ,, \quad ,, \quad ,, \quad ,, \quad £\frac{9}{2}\times75\tfrac{1}{2}$$

$$=£\frac{9\times151}{4}=£\frac{1359}{4}=£339\tfrac{3}{4}$$

.$\cdot$. the $4\frac{1}{2}\%$ Loan is the better investment from the point of view of income.

Another method of dealing with this question is to express the yield (or income) as a percentage of the market price.

Thus $\dfrac{3\frac{1}{2}}{75\frac{1}{2}}\times100=\dfrac{700}{151}=4\dfrac{96}{151}\%=4\cdot6\%$ and a trifle over.

$\dfrac{4\frac{1}{2}}{95\frac{1}{2}}\times100=\dfrac{900}{191}=4\dfrac{136}{191}\%=4\cdot7\%$ and a trifle over.

.$\cdot$. the second loan yields a higher percentage on the investment.

On any particular day prices tend to find such a level that investment in any of the British Government securities yields about the same percentage. Thus $2\frac{1}{2}\%$ Consols are at about 60 and yield $\dfrac{2\frac{1}{2}}{60}\times100=4\cdot2\%$ nearly, on a day when 4% Funding Loan is at 97 and yields $\dfrac{4}{97}\times100=4\cdot12\%$ and 5% Conversion Loan is at 107 and yields $\dfrac{5}{107}\times100=4\cdot6\%$, so you see the yields are much more nearly alike than their name percentages $2\frac{1}{2}$, 4, 5 would lead you to expect. On the same day Australian 5% were at 93, Ceylon 6% at $105\frac{1}{4}$, Argentine 4% at $68\frac{1}{2}$, all of which give higher yields than the British ones quoted and show that people with money were being tempted to invest it abroad, though, as was pointed out before, a high

yield often means a greater risk that the capital will not be repaid when due.

It has been pointed out that the interest on Government stocks is a charge on the revenue. In the budget estimates provision is made for the service of the National Debt. If possible this includes certain sums of money intended to pay back part of the principal, as well as to pay the interest, but sometimes the Sinking Fund has to be suspended. When the date comes for any particular stock to mature if the Government has not accumulated all the money necessary to redeem the certificates it has to make a fresh borrowing, but it need not offer the same rate of interest to its new creditors, so it may convert a debt at 5% interest into another debt at say 4%. It is that sort of financial operation which has created the various stocks called Conversion Loans whose names you can see in the papers.

How much the rate of interest can be reduced depends partly on the average yield of Government securities when the conversion is about to be made. The gigantic conversion of about £2,000,000,000 from 5% to $3\frac{1}{2}$% in 1932 will be in the minds of all readers, no doubt. The Miss Black referred to on page 40 may now be one of the new creditors of the Government if she converted her holding.

Local Governments, like town councils, have to borrow money and issue Stock Certificates at times, *e.g.* to build a new school or develop a new housing estate, which would cost far too much to be paid for by one year's rates. Of course, in the end it has to be paid for by the ratepayers, but they spread the cost over a number of years, say 30, during which they pay interest at an agreed percentage, and gradually set aside enough money to repay the loan. This means that they pay more in the end, *cf.* hire-purchase.

You will see Corporation stocks quoted in the papers in just the same way as Government stocks, and the arithmetic connected with them is exactly similar.

Here are a few whose yields we might compare :—

L.C.C. 3% at $68\frac{3}{4}$, Birmingham $3\frac{1}{2}$% at $79\frac{3}{4}$, Glasgow 5% at 104, Swansea 6% at $105\frac{1}{2}$, Liverpool $4\frac{1}{2}$% at 100.

L.C.C. 3% at $68\frac{3}{4}$ yields $\dfrac{3\times4}{275}\times100\% = 4\cdot4\%$ nearly.

Birmingham $3\frac{1}{2}$% at $79\frac{3}{4}$ yields $\dfrac{7\times4\times100}{2\times319}\% = 4\cdot4\%$ nearly.

Glasgow 5% at 104 yields $\dfrac{500}{104}\% = 4 \cdot 8\%$ and a trifle.

Swansea 6% at $105\frac{1}{2}$ yields $\dfrac{6 \times 2 \times 100}{211} = 5 \cdot 7\%$ nearly.

Liverpool $4\frac{1}{2}\%$ at 100 yields, of course, $4 \cdot 5\%$

Again you notice that the yields are much more nearly equal than the nominal rates of the stocks. All the prices quoted here were on the same date.

The yields are important when you are considering investments, but if you already possess stock certificates the rise and fall of the price does not affect your income until you come to sell. It does, however, affect the value of your capital. If two men had each £1,000 but invested it differently, a year later one might be worth £900 and the other worth £1,200, *i.e.* those might be the market values of their holdings —it does not necessarily follow that either of them has sold his certificates or means to do so. A man's estate, *i.e.* all his possessions, including his stock certificates, must by law be valued when he dies, even if the executors retain possession of it for several months before they sell it or distribute it to the legatees.

EXERCISES.

1. Find from a newspaper the names of three British and three foreign Government stocks not mentioned in the text.

2. Income tax went up to 5/- in the £ standard rate. Work the example on page 39 for half a year at that time.

3. Look up to-day's prices of such of the stocks mentioned on page 39 as are still on the market.

4. Work out the present yields of five British Government stocks of different nominal rates.

5. Find out whether the Corporation stocks mentioned on page 44 are still on the market, and whether their yields are now higher or lower than on the day the extract was made.

6. A man dies owning £2,345 of $3\frac{1}{2}\%$ Conversion Stock, £575 of Funding 4% and £880 of India $4\frac{1}{2}\%$. If his death

occurs on the day previous to that on which you work this
exercise, what will the executors return as the value of this
part of his estate ?

7.   A man wishes to buy £800 of Metropolitan Water Board
3% B Stock at 89¼.   What will it cost him ?

8.   What annual income should a Canadian receive if he
invests $550 in Canadian 3½ per cents. at 101¼ ?

BUYING TO SELL AT A PROFIT

So far we have thought of buying goods to supply our wants and investing or lending money to secure an income, and we have seen that buying can never take place unless someone wants to sell, nor investing of the kind we have considered unless someone wants to borrow.

Let us now consider how the sellers of goods acquire their stocks. In olden days very often both buyer and seller were farmers, one of whom grew enough wheat for two, and the other had enough cows to provide milk for two, and they just exchanged the produce they did not want. But life in towns is not so simple as that.

Suppose you visit a boot-shop. The shop assistant shows you several pairs of boots, each carefully marked with a price. Where did they come from, and how were the prices fixed ? Probably they came from various boot warehouses owned by wholesale sellers of boots. A wholesale seller will not, as a rule, sell one pair of boots by itself—he sells a dozen pairs at a time, and his customers are the shopkeepers. Suppose you select a pair marked 18/9. Then to you 18/9 is a buying price, but to the shopkeeper it is a selling price. But he *does* think of a buying price in connection with the same pair of boots. If he paid the wholesale merchant £9 for a dozen such pairs *his* buying price was 15/– per pair, and he made a gain or profit of 3/9 on that particular pair of boots.

There are several reasons why he is entitled to make his selling price higher than his buying price. Here are some of them from your point of view—the shopkeeper himself thinks of it as his way of making a living.

(*a*) When he chose those boots from the wholesaler's stock he did not *know* that he would be able to sell all the dozen. He was to a certain extent taking the same sort of risk as an investor—he might not be able to get his money back.

(*b*) Some time might elapse between the day he bought the boots and the day he sold them ; if he had invested his 15/– in

some other way than buying boots with it he could have had interest.

(c) He has done you a service. By keeping a shop near your home he has enabled you to choose the pair of boots you liked instead of having either to take a long journey to fetch them or to put up with what someone else chooses.

If he thinks of the 3/9 as a sort of interest, (it is not interest in the ordinary sense because nothing is known about time in connection with it), he will reckon the yield as $\dfrac{3\frac{3}{4}}{15} \times 100\%$ of the buying price, *i.e.* 25%.

This is the type of sum an outsider usually thinks of when he hears that a trader has made a profit of, say, 6%. He imagines a buying price of 8/4 (100d.) and a selling price of 8/10 (106d.), or, if he knows that the buying price was £3 : 15, he concludes that the selling price was $\dfrac{106}{100}$ of £3 : 15

$$= £\frac{106}{100} \times \frac{15}{4} = £\frac{159}{40} = £3 : 19 : 6.$$

In all these cases the profit has been compared with the buying price by means of a percentage. But any two sums of money can be compared, and as a matter of fact the trader himself is much more likely to compare the profit with the selling price.

When you have paid the 18/9 for your boots he divides it into two parts, and says to himself : " Here is 3/9 profit out of this 18/9, that is $\dfrac{3\frac{3}{4}}{18\frac{3}{4}} \times 100\% = 20\%$.

Again, when *he* speaks of a 6% profit he thinks of a selling price of 8/4 (100d.) and a buying price of 7/10 (94d.), or, if he knows that the buying price was £3 : 15, he concludes that the selling price is $\dfrac{100}{94}$ of $£3\frac{3}{4} = £\dfrac{100}{94} \times \dfrac{15}{4} = £\dfrac{375}{94} = £3 : 19 : 9\frac{1}{2}$ (nearly).

There is no need for you to find these things confusing if you remember that the % sign is incomplete in itself and always requires some such phrase as " of the buying price," " of the selling price," " of the turnover," " of the day's takings," " of the marked price," " of returns," etc., to make it clear.

Of course, all the members of a particular firm need not

write the phrase every time, because these people are agreed as to what they mean when they speak of percentage profit, but if you are merely practising arithmetic or writing for a firm whose customs you do not know you should *always* make your statements in full.   If you are working from information supplied by someone else and consider that its meaning is not clear you should be particularly careful to explain accurately how you have interpreted it.   Thus, in the example above someone says that on goods bought for £3 : 15 a profit of 6% is expected, and you reply :   " Well, a selling price of £3 : 19 : 6 would give a profit of 6% of the buying price, *or* a selling price of £3 : 19 : 9½ would give a profit of 6% of the selling price."

Notice that the actual profit is larger when the 6% is calculated on the selling price, and conversely when the same actual profit is compared first with the buying price and then with the selling price, the percentage is smaller in the second case.

In particular, it is worth while to remember that to ensure a profit of—

50% of the selling price you must add				100%	} of itself to the cost price.
33⅓%	,,	,,	,,	,,	50%	
25%	,,	,,	,,	,,	33⅓%	
20%	,,	,,	,,	,,	25%	
16⅔%	,,	,,	,,	,,	20%	

and so on.   These are easily worked percentages, and are of very frequent occurrence, so you should pay special attention to them, and think out the quickest way of working them.

For in spite of differences in its application, percentage is a very important way of comparing business transactions happening at different times and under different conditions.

Now let us return to that boot-shop.   We have seen that your buying price was the shopkeeper's selling price.   Similarly, his buying price was the wholesaler's selling price.

But probably the wholesale merchant had bought the boots from a manufacturer in much larger quantities, say a hundred dozen pairs for £750, or £7 : 10 : 0 per dozen, so he made an actual profit of £1 : 10 : 0 per dozen pairs or $\frac{1\frac{1}{2}}{9} \times 100\%$ of his selling price = 16⅔% of his selling price.

£750 for a hundred dozen pairs of boots is the manufacturer's selling price.   He did not buy the boots ready-made.   He

bought leather and thread, and metal eyelets, and boot laces. He also had to have machines, and work-rooms, and to pay wages to his workers, so to find his cost price is a difficult matter. He probably has a costing department in his office, and the clerks there make calculations all day long. For argument's sake let us suppose that they decide that this particular consignment of boots cost him £675. The following might be the extract from the costing book :—

Raw materials used on job	£311 : 5 : 7
Wages paid (either by piece-rate or by time) ..	324 : 15 : 0
2% of wages paid to cover foreman's wages ..	6 : 9 : 11
10% of wages paid to cover machinery and other factory expenses	32 : 9 : 6
	£675 : 0 : 0

This works out at £6 : 15 : 0 per dozen pairs or 11/3 per pair. His rate of profit is then $\dfrac{75}{750} \times 100\%$ of his selling price $= 10\%$ of his selling price.

This is not, however, his net rate of profit, as he has certain distributive costs as well as manufacturing costs—he must provide packing material, and warehouse space, and pay his clerks and salesmen and managers—but we need not consider this further—it is true in greater or less degree of the retailer and the wholesaler as well. We have, as you see, already worked a number of percentage sums all about the same pair of boots. In this case we have supposed that every time they were sold a profit was made. That might not always happen. It is never good for trade if articles stay too long in stock, so when the merchant found that of the hundred dozen pairs he still had ten dozen pairs left he might decide to sell the rest at a lower price, perhaps even as low as £7 per dozen, rather than keep them lying about. In the same way the retailer might sell off a few pairs, say two, at 14/-. His turnover for this dozen pairs of boots is the total money he has received when he has sold them all, *i.e.* $18/9 \times 10 + 14/- \times 2 = £10 : 15 : 6$. His cost was £9, so his profit is $\dfrac{1\frac{31}{40}}{10\frac{3}{40}} \times 100\%$ on turnover,

$= \dfrac{7100}{431}\% = 16\frac{204}{431}\%$ on turnover.

When goods are sold below cost (*e.g.* 14/- is below 15/- in the paragraph above) it is possible to express the fact as a loss per cent. 1/- is $\frac{1}{15} \times 100\%$ of 15/- = $6\frac{2}{3}\%$ of 15/-.

But such calculations are only of theoretical interest—the shopkeeper gets no help in his business by considering his losses as percentages, so it is not practical to call this application of arithmetic " Profit and Loss." A business house does have to keep a " Profit and Loss Account," but this is not concerned with percentages.

As a rule there is a larger rate of profit on articles which are small and seem cheap. If, for instance, two pencils can be made for 1d. and they are sold at 1d. each, the profit is 50% of the selling price or 100% of the cost price, yet no one thinks of suggesting that 1d. is an exorbitant price to pay for a pencil, whereas if people suspected a boot manufacturer of making 100% profit on his cost price they would call him a profiteer. This is an example of how carefully statements about percentage profit should be made, for they may very easily be misleading if incomplete in any way.

Here are two very generally used expressions, which, though actually incomplete, are not likely to be misunderstood :—

1. If a manufacturer states, " Owing to a rise in the price of leather all prices in this catalogue will be raised 5%," then you must multiply all the prices by $\dfrac{105}{100}$ to obtain the new prices (or what is quicker, divide the price as printed by 20, and add your result to the price, since $\frac{5}{100} = \frac{1}{20}$).

2. If a shopkeeper states " during the sale all prices will be reduced 10% " then the sale prices will be $\frac{90}{100}$ of the prices marked on the goods.

Another case in which the general public is accustomed to working a percentage on the marked price of goods occurs when a shopkeeper allows " discount for cash." This means that he is a credit trader, and most of his customers do not pay for their goods immediately but send cheques after a long interval, and he has taken the probable delay into account in fixing his prices, so if a customer is willing to pay at once, *i.e.* to produce cash, the seller is willing to lower the price.

He may state this by saying he allows a discount of $2\frac{1}{2}\%$ for cash—then a bill for £1 : 10 : 0 could be settled by paying £1 : 9 : 3. Sometimes this kind of discount is quoted as 1d. or 2d. in the shilling, instead of as a percentage. 1d. in the shilling is equivalent to $8\frac{1}{3}\%$.

Trade discount is a similar allowance where the distinction is made, not between the methods by which the accounts will be settled, but between the purposes for which the customers require the goods—thus a carpenter who regularly buys nails from an ironmonger may be allowed, say, 10% off the price which would be charged to a casual customer, or even to a regular one who buys nails for his private use and not for the purposes of his trade.

You may have found for yourself that a somewhat similar type of discount is allowed by sports' outfitters to sports' clubs —you pay less for your tennis balls if you buy them through the secretary of the tennis club than if you go to the shop yourself.

The financial world uses the term " discount " in still other senses of which you will hear later.

Sometimes merchants buy goods at different prices but sell all at the same price, or mix them in some way before selling them. In this connection the following types of sum may occur :—

1. Two kinds of tea bought at 1/6 and 1/10 per lb. are mixed in the proportion of 3 lbs. of the cheaper to 2 lbs. of the dearer, and the merchant plans for a profit of 16% of his selling price. What does he charge for the mixture ?

Average cost price is ($\frac{3}{5}$ of $1/6 + \frac{2}{5}$ of 1/10) per lb. $= \dfrac{8/2}{5}$

per lb. Out of every 100d. S.P. 16d. is profit and 84d. is C.P.

$\therefore$ S.P. is $\dfrac{100}{84}$ of C.P.

$\therefore$ S.P. is $\left(\dfrac{98}{5} \times \dfrac{100}{84}\right)$d. per lb. $= 23\frac{1}{3}$d. per lb.

$\therefore$ He should charge 2/- a lb. for the mixture.

2.   Coffee bought at 2/2 and 2/6 per lb. is mixed and the whole quantity sold at 3/– a lb. The merchant finds he has made 18% on turnover. What fraction of the mixture consisted of the cheaper coffee ?

On every lb. of the cheaper coffee 10d. profit is made, or $\frac{10}{36}$ of the S.P.

On every lb. of the dearer coffee 6d. profit is made, or $\frac{6}{36}$ of the S.P.

On every lb. of the mixture a profit of $\frac{18}{100}$ of the S.P. is made since the whole quantity was sold.

$$\frac{10}{36} \text{ is greater than } \frac{18}{100} \text{ by } \frac{5}{18} - \frac{9}{50} = \frac{125-81}{18\times25} = \frac{44}{18\times25} = \frac{22}{9\times25}$$

$$\frac{6}{36} \text{ is less than } \frac{18}{100} \text{ by } \frac{9}{50} - \frac{1}{6} = \frac{27-25}{6\times25} = \frac{2}{6\times25} = \frac{3}{9\times25}$$

On the whole the profit is neither less nor more than $\frac{18}{100}$ of the S.P.

∴ 3 lbs. of the cheaper coffee was mixed with 22 lbs. of the dearer, *i.e.* $\frac{3}{25}$ of the mixture consisted of the cheaper coffee.

To verify this result notice—

  3 lbs. at 2/2 costs 6/6.
  22 lbs. at 2/6 costs £2 : 15 : 0.
             Total   £3 : 1 : 6.
25 lbs. at 3/– brings in £3 : 15 : 0.
             Profit   13/6.

13/6 as a percentage of £3 : 15 : 0 is $\frac{13\frac{1}{2}}{75}\times100 = \frac{27}{2}\times\frac{4}{3} = 18$

Another type of problem depending on mixtures is exemplified below :— [1]

1.   If 9 oz. of gold 10 carats fine, and 5 oz. 11 carats fine, be mixed with 6 oz. of unknown fineness to make a resulting mixture 12 carats fine, what was the unknown fineness ?

The final 20 oz. of alloy contain ($\frac{12}{24}$ of 20) oz. of pure gold. Of this 10 oz. ($\frac{10}{24}$ of $9 + \frac{11}{24}$ of 5) oz. comes from the first two nuggets, *i.e.* $6\frac{1}{24}$ oz. are accounted for.

[1] These two questions were originally examination questions :—
    (1) Cambridge Senior Local.
    (2) Civil Service.
Both are quoted on p. 348 of *Longman's Senior Arithmetic for Schools and Colleges.* Published by Longman. The solutions are my own.

The remaining $3\frac{23}{24}$ oz. comes from the 6 oz. nugget, whose fineness is therefore—

$$\frac{95}{144} \text{ of } 24 = 15\frac{5}{8} \text{ (carats).}$$

2.   If, at a certain date, the silver coin of Britain was made of 37 parts pure silver, and 3 parts copper, and a pound Troy of this metal was coined into 66/- find the weight of pure silver in a shilling.

$\frac{37}{40}$ of any silver coin was pure silver.

A shilling contained $\frac{37}{40}$ of $\frac{12}{66}$ oz. Troy $= 3 \cdot 36$ dwt.

EXERCISES.

1.   A merchant is planning to make $33\frac{1}{3}\%$ on his takings. What fraction of the cost prices will the marked prices be ? At what prices will he mark single articles which he buys at 28/6 a dozen, 50/- a gross, 3/10 a half-dozen ?

2.   At sale time one shop advertises " a genuine 20% reduction," another offers a discount of 2d. in the shilling. Both catalogues show original prices of 5/8, 15/3, 4 guineas. What are the sale prices ?

3.   " That man is making 35%. It's a shame ! " If an article marked £15 : 10 : 0 caused this remark, what did the speaker think the shopkeeper gave for it ?

4.   A grocer buys sugar at 18/8 a cwt. and sells it at $2\frac{1}{2}$d. per lb., but about 2 lbs. in every cwt. gets wasted. What is his percentage profit on turnover ?

5.   A large firm usually marks its goods with the intention of securing 25% on takings, but advertises a special line at " 10% below cost." On a certain day customers pay £60 : 15 : 0 for goods from ordinary stock and £20 : 10 : 0 for the special line. How much had these goods cost the firm, and what were the profits for the day ?

PARTNERSHIP: FINANCING INDUSTRY AND COMMERCE

IN all the transactions discussed so far we have referred to the buyer and the seller as single persons, but you know perfectly well that a shop or factory is often owned by two or three people and is referred to as Marshall and Snelgrove's, or Huntley and Palmer's, showing two names, or as the Maypole Company, implying that numerous people are concerned.

We will now consider the arithmetic of partnership in business, first in the simple case where Tom Jones and Henry Smith decide to start a small tobacco shop. We will suppose that Jones has £200 and Smith £300. They buy premises which cost £250, spend £40 on doing them up and £90 on buying stock (goods for sale) and put aside £20 for running expenses. Then Jones takes £40 and Smith £60 of the £100 they have not used, and in the same way when they make a profit Jones has $\frac{2}{5}$ of it and Smith $\frac{3}{5}$ of it. They are partners, but did not supply equal amounts of the capital required to start the business. If the shop is not a success, and it and everything in it is valued at £300 when the partnership is dissolved, Jones is entitled to £120 and Smith to £180. If Smith paid Jones £120 he would own the whole business, and would be said to buy his partner out.

But starting a business or factory on a large scale is much more complicated. Let us imagine that Jones has invented a new kind of hair oil. He has made a good deal of it in his laboratory, has tried it on his friends, and is convinced that the recipe is good and that it will not be too expensive to make in large quantities—that it is commercially practicable. But he reckons that it will cost £10,000 to equip and start a factory, and Jones only possesses £200, so he must borrow. He cannot, however, levy taxes to provide the interest—he will have nothing with which to pay interest until he has made a success of the factory and can sell the hair oil at a profit. So first of all he must persuade people that there is a really good prospect of making a profit, and instead of offering an annual rate of

interest he offers a share of whatever profit there is. In his prospectus he, in fact, invites the lenders to become partners in this business, only it is more usual to call them shareholders, and the certificates issued to them showing the terms on which they have lent the money are called Share Certificates. Jones himself is a shareholder if he contributes his £200, and he and a few others will be appointed directors, among whom there will be a managing director who will spend all his time at the factory and will receive a salary as well as his share of the profits when there are any. The other shareholders are only occasionally summoned to a meeting—for them the business is just a form of investment ; their Share Certificates can be bought and sold, and the arithmetic involved is very similar to that discussed in Chapter VI, only that the rate of interest is not fixed, so that the income varies from year to year. They are the ordinary shareholders of the company, and share the risks of bad trade as well as the profits of a good year. Sometimes Preference Shares are also issued—this means that a limited number of the shareholders hold certificates bearing a fixed rate of interest—say 5%—which is paid before the rest of the profits are shared out among the Ordinary shareholders ; so a Preference shareholder is more likely to get something in a bad trading year, but he will not share to the same extent as the others in the prosperity of a good trading year.

A man owns £350 G.W. Railway Ordinary Shares on which a dividend of $1\frac{1}{2}\%$ has just been declared. He also has £55 of 5% Preference Shares in the same company. Income tax is deducted at 5/- in the £. What sum will he receive from the Company ?

Tax is £¼ per £ . ˙. out of £1 : 10 he receives £1 : 2 : 6
                    and out of £5   ,,   £3 : 15 : 0

His total receipts are $3\frac{1}{2} \times$ £1 : 2 : 6$+\frac{11}{20}$ of £3 : 15 : 0 (since $\frac{55}{100} = \frac{11}{20}$)

$$
\begin{array}{rl}
= & £3 : 7 : 6 \\
+ & \quad : 11 : 3 \\
+ & 1 : 17 : 6 \\
+ & \quad : 3 : 9 \\
\hline
& 6 : 0 : 0 \\
\hline
\end{array}
$$

As with Government stocks (see p. 40) newspaper quotations of the prices of share certificates are very much shortened,

and readers are expected to know the customs of the business world. Thus, if the G.W. Ordinary Shares are quoted at 33 this probably means £33 per £100, whereas Assam Co. Tea shares at 14/– means 14/– for a £1 share, and J. Lyons at $5\frac{1}{8}$ means £5 : 2 : 6 for a £1 share, and again Phœnix Insurance Co. (£10) at $14\frac{3}{8}$ means £14 : 7 : 6 for a £10 share. As a rule, it is % and £ which are omitted, and most businesses issue £1 share certificates, but there are exceptions.

When stock and share certificates are bought and sold certain moneys have to be paid in addition to the agreed price. The stockbroker has to be rewarded for arranging the deal— he usually charges both buyer and seller a commission called brokerage, say 2/6 or 5/– per £100 dealt with ($\frac{1}{8}$ or $\frac{1}{4}$ per cent. or even 1 per cent. or sometimes 3d. or 6d. per share). Then the buyer has to pay stamp duty to the Government (10/– per cent.), though some Government stocks can be transferred to new owners without incurring this expense, but both buyer and seller have always to put contract stamps on the formal state-ments of their transactions with the stockbroker.

Thus, to buy £100 Government stock at $103\frac{15}{16}$ (brokerage 1%, contract stamp 1/–) actually costs £104 : 19 : 9, or *more* than the quoted price.

By selling £100 Government stock at $106\frac{3}{8}$ (brokerage 1%, contract stamp 1/–), the vendor only secures £105 : 6 : 6, or *less* than the quoted price.

In other words, brokerage makes it more expensive to buy and less profitable to sell, but not very much in either case, so in some calculations it can be neglected if a " round sum " result is all that is required.

The first of the following rhymes which appeared in the *Mathematical Gazette*, July, 1924, may help to remind you of these facts. The second is about the income obtained by buying stock.

    1.   " Please, sir, do you add the brokerage or subtract it ? "

> The Broker must have eggs and ham,
> And mend the little broker's pram.
> How can he pay his fare to town
> By giving you the odd half-crown ?
> So pay some more without a shock
> When Mr. Broker buys you stock,
> And when the Broker helps you sell
> And takes his nibble off, say, " Well,
> You've earned it " : don't say anything that might hurt
>   his feelings.

2. "Please, sir, is his income 5 per cent. of the stock he bought or of the price he paid for it ?"

> The Railway neither knows nor cares
> How you obtained your blessed shares,
> Bought in a pawn-shop second-hand
> Or found in Joe's umbrella stand.
> Why should it pay you 5 per cent.
> On what *you say* that you have spent ?
> And if you stole them, I'm afraid
> Your fortune won't be quickly made
> By 5 per cent. *of what you paid.*

The following examples can be compared with those on page 42 on Government stocks :—

Examples.

1. A man has £75 to invest. He selects Newcastle-on-Tyne Gas Works as a suitable type of share to buy. The shares are at 25/6 and brokerage and transfer charges are $\frac{1}{4}\%$ and $\frac{1}{2}\%$ respectively. How many shares can he buy ?

$$£\frac{3}{400} = \frac{60}{400}/- = \frac{3}{20}/-$$

Cost of each share is $25\frac{1}{2}/- + \frac{3}{20}/- = 25\frac{13}{20}/-$

$\therefore$ he can buy $\dfrac{75 \times 20}{25\frac{13}{20}}$ shares $= \dfrac{75 \times 400}{513} = \dfrac{30,000}{513}$

$$= 58 + \text{ a fraction.}$$

$$\begin{array}{r} 58 \\ 513)30000 \\ 4350 \end{array}$$

$\therefore$ he *can* buy 58 shares.

Parts of a share are not sold, but the broker may, of course, try to persuade him to add a little more money and secure 60 shares, or he may decide to buy a less number.

2. A man wishes to buy 80 shares in Marks and Spencer's Stores. The shares are quoted at $4\frac{13}{16}$, and he reckons expenses at 2%. What is he prepared to spend ?

$£(\frac{2}{100} + 4\frac{13}{16})$ is the estimated cost of each share.

$\therefore$ he is prepared to spend—

$$80 \times £4\frac{333}{400} = £\frac{80 \times 1933}{400} = £386 : 12 : 0$$

3. The owner of 150 Canadian Pacific Railway $25 shares is obliged to sell them at $18\frac{1}{2}$. What does he receive ?

$$\$150 \times 18\frac{1}{2} = \$2,775.$$

When deciding on the relative merits of commercial stocks and shares you must be guided by whether the price has recently been going down or up, when the last dividend was paid and how large it was, whether the company has to pay interest on Preference Shares and so on ; but the yield cannot be definitely worked out when no rate was fixed on the original borrowing. You may, however, hear such statements as "Company A is likely to prove a better investment than Company B. I should say they would yield about $7\frac{1}{2}$ and 6 per cent. respectively."

Like commodities, stocks and shares can be bought in the hope of selling at a profit, *i.e.* with no intention of keeping them to secure an annual income, but for the sake of the appreciation, or increase, in the capital value. There is, of course, a certain amount of risk in this, as the capital may depreciate instead. Taking this risk is called speculating, but when done on not too large a scale it is a perfectly legitimate form of business.

Example.—A man bought 5% War Loan when it was at $94\frac{1}{4}$, spending £250, received the half-yearly dividend, and a month later sold the stock at 102. He invested the whole proceeds in Kodak stock at 74. What is now the nominal value of his holding ?

The man bought £$\dfrac{250}{94\frac{1}{4}} \times 100$ War Loan.

The dividend yielded £$\dfrac{250}{94\frac{1}{4}} \times 2\frac{1}{2}$ ⎫ Together

The sale yielded   £$\dfrac{250}{94\frac{1}{4}} \times 102$ ⎭ £$\dfrac{250}{94\frac{1}{4}} \times 104\frac{1}{2}$

He obtained £100 Kodak stock for every £74 of cash available.

∴ his holding is—

$$£\frac{250}{377} \times 4 \times \frac{209}{2} \div 74 = £374 : 11 : 7 \text{ (nearest 1d.)}.$$

This is, of course, possible, but unlikely. It is, however, the result of using the data exactly as given, which is the best a mere arithmetician can do. Probably the investor would pay an extra few shillings and buy £375 of the Kodak stock.

Sometimes an investor transfers his holding from one stock to another in order to improve his income.

Thus, suppose a man invested £350 in India $3\frac{1}{2}\%$ stock when it was at 63. A year or two later, when it is at $78\frac{1}{2}$, he sells it and invests the proceeds in L.M.S. 4% Guaranteed Stock at 70. Find what change this makes in his income, neglecting brokerage and transfer fees.

First income $£\dfrac{350}{63} \times 3\frac{1}{2} = £19 : 8 : 10$

Proceeds of sale $£\dfrac{350}{63} \times 78\frac{1}{2}$

New income $\dfrac{4}{70}$ of $£\dfrac{350 \times 157}{63 \times 2} = £\dfrac{1570}{63} = £24 : 18 : 5$

The transfer increases the income by £5 : 9 : 7.

Three other types of share certificates had better be mentioned :—

1. Deferred Shares do not receive any portion of the profits until after the Ordinary Shares have been paid a minimum percentage. They are often held by the man who originally started the business, and who feels responsible for making it as profitable as possible to the other shareholders. Sometimes after a bad year he makes his Ordinary Shares into Deferred Shares.

2. Debenture Shares are the exact reverse. They are fixed interest shares and receive the very first share of the profits. Indeed, if in any year there are no profits the debenture holders can demand that the buildings or other property of the business shall be surrendered to them.

3. Partly paid shares. Sometimes when a business is to be started the promoters ask for subscriptions totalling say £100,000 in £10 shares, but only require perhaps £40,000 at once. Then each of the investors would send £4 per share and receive a certificate saying that he (or she) was the owner of a £10 share £4 paid. This certificate entitles the holder to his share of the profits of the business and can be sold like any other certificate, but if the time comes when the business is to be extended, whoever then holds it is liable to be called on for the other £6 or part of it as required by the company. When the whole £10 has been paid the certificates are marked "Fully Paid."

Here is a harder and rather different example of proportional sharing of profits.

Suppose a man owned a number of houses. He decides to sell them and start a business. He has £350 ready, he borrows £200 from A, £320 from B, £500 from C, £630 from D, and uses this £2,000 to start his business, in the profits of which they are to share for a time. As he sells his houses he pays off his debts. A's money is in the business 2 months, B's 4 months, C's 5 months, D's 9 months. At the end of the year £150 of profit has been made. How should it be divided?

Consider these numbers :—

$$A \quad 2 \times 200 = 10 \times 40$$
$$B \quad 4 \times 320 = 10 \times 128$$
$$C \quad 5 \times 500 = 10 \times 250$$
$$D \quad 9 \times 630 = 10 \times 567$$

Owner $\quad 350 \times 12 + 10 \times 200 + 8 \times 320 + 7 \times 500 + 3 \times 630$
$$= 10 \quad (420 + 200 + 256 + 350 + 189).$$

Rejecting the 10 factor :—

A	40
B	128
C	250
D	567
Owner	1415
	2400

We should expect this figure, as, on the whole, £2,000 was earning interest for 12 months. Its occurrence is, therefore, a check on the previous work.

A therefore receives $\dfrac{40}{2400}$ of £150 or   £2 : 10 : 0

B   ,,   ,, $\dfrac{128}{2400}$ of £150 or   £8 : 0 : 0

C   ,,   ,, $\dfrac{250}{2400}$ of £150 or £15 : 12 : 6

D   ,,   ,, $\dfrac{567}{2400}$ of £150 or £35 : 8 : 9

Owner ,,   ,, $\dfrac{1415}{2400}$ of £150 or £88 : 8 : 9

£150 : 0 : 0

Once more the addition is completed as a check on the calculations. We might, of course, have stated that the interest would be $\dfrac{150}{20 \times 12}\%$ per month $= \frac{5}{8}\%$ per month. This is only another form of the same result.

There is, however, another kind of partnership in business. This is the way in which the Co-operative Societies finance their undertakings, which are run for and by the people whose wants they supply.

Like municipalities they have no possessions or resources apart from their members, yet by acting together they can supply the wants of each member and also provide benefits for the society as a whole.

The members or shareholders each subscribe at least £1, but not more than £200 to the capital of the Society, and interest is paid on these shares at a fixed rate, say $3\frac{1}{2}\%$.

.   But they cannot be bought or sold like the shares in the other businesses we have considered. When a member wants his money back he can withdraw it in whole, or in part, but he does this directly, not by finding someone else to take his share in the Society.

All the member - shareholders help actively in producing the profits of the Society, for they are also the customers who buy from the shops. Indeed, this is the root idea of the co-operators : they regard themselves first and foremost as people who must buy to supply their wants, and who believe that if they unite to do their buying they can supply these wants more satisfactorily—you remember that on pages 14 and 15 we spoke of buying matches and coal at a lower price if we bought in large quantities.

The shops, therefore, are not someone's way of making a living. As long as they supply what the customers need it is not very important that they should make a profit, and the profits they do make are mainly the savings caused by a large number of consumers agreeing to buy the same kind of cocoa, or butter, or jam, instead of each buying a small quantity of her own special brand. You see, if they can buy butter (say) at 10/10 per dozen pounds, to sell it one pound at a time they cannot charge less than 11d. a pound, so cannot help making a profit of 2d. on the dozen pounds—thus, if they have 400 members, each of whom wants 1 lb. or more of butter, they will make a profit of 5/- or 6/- on this alone

almost without intending it. In practice they will make much more, for they will buy in much larger quantities, and will not sell at the lowest possible price because they have to allow for expenses of management.

So though large profits are not the aim of the co-operators, they usually do make much more than enough to pay the fixed rate of interest on the capital : you remember there are no really big shareholders—no one has lent more than £200, and many much less.

The surplus profits are shared out quarterly as a dividend on purchases. An account has been kept of how much each member has bought in the Society's shop, and for every £1 he has spent he gets a share of the profits. The " divi " is (say) 1/6 in the £1, so a member who had spent £1 a week during the quarter would get thirteen times 1/6, or 19/6, returned to him (or her). And many of the members *do* spend regular weekly sums, for these shops are not luxury shops to be visited only occasionally—they have often added clothing and furnishing departments, but their primary intention is to supply the daily wants of their members—groceries and bread and meat and fruit—the necessities on which some part of everyone's money must be spent.

The members hold quarterly meetings and decide how the profits shall be shared. They do not distribute all profits as dividend, but build recreation halls, or arrange lectures, or pay to insure their members. And more and more a number of Co - operative Societies combine to finance wholesale houses and factories, so that the manufacturing and merchanting as well as the retail buying and selling are done co-operatively.

When putting up a new factory co-operators do sometimes borrow money like other firms, but they do not make the lenders shareholders in the business ; instead, they make an agreement that *if* they get into money difficulties and cannot repay the debt certain land or buildings which the borrowers own shall become the property of the lenders, but this will not happen if the fixed rate of interest is paid regularly and the debt re-paid at the proper time. This plan of pledging land as security for a debt is called borrowing on mortgage —co-operators are not the only people who do this.

The really important thing to notice is that you cannot become a shareholder in a co-operative business merely by

lending money, you must also help to make the business a success by buying goods from its shops. Most of the customers at such shops are partners in the business and share in its profits, but the assistants will not refuse to serve a non-shareholder if he goes in and asks for something which is on sale : to this extent these shops are just like those which are privately owned, and were discussed at the beginning of the chapter.

<div align="center">EXERCISES.</div>

1. A man draws £11,200 out of a bank, which pays $2\frac{1}{2}\%$, he invests £602 : 13 : 4 in 4% Consols at 113, and the remainder in 3% Railway Stock at 97. Find the change in his income.

2. Two partners originally contributed £560 and £310 to start a business. How should they share the first £100 of profit ?

3. Find from a newspaper the quotations of G.W. ordinary shares, Assam Co. Tea shares, J. Lyons shares, and Phœnix Insurance Co. (£10) shares and compare them with the prices on page 57. State in full two other of to-day's quotations.

4. Work Question 1 again if the bank acts as broker and charges $\frac{1}{8}\%$ commission on the stocks bought, also deducting the cost of the Government stamps for both stocks at 10/– per cent. from the total sum available.

5. Study the market reports and find out whether the shares of the companies mentioned on page 58 are still being bought and sold. Work the sums again at to-day's prices.

6. A man sees that Marks and Spencer are likely to pay 35% on their Ordinary Shares, the market price of which is $9\frac{3}{16}$. Will it pay him to buy some shares with money on which he is now receiving 4% ?

7. A woman has £5 on deposit at the local Co-operative Stores and interest on it is at 3%. In the four quarters she spends £15 : 10 : 0, £14 : 5 : 0, £16 : 15 : 0, £13 : 15 : 0 at the shop, and the dividends are 1/3, 1/6, 1/6, 1/4 in the £. How much does she save up through her membership that year ?

ACCUMULATING MONEY WEALTH

On page 26 we considered how a man who had saved £200 could use it profitably, and in later chapters we have discussed other forms of investment. But before money can be invested it must be saved or accumulated in sufficient quantities. The most elementary way of saving is to have a money-box and save the actual coins, and we must begin in this fashion, but once we have begun there are various organizations which help us to continue. The simplest ones are called Savings Banks, and the Post Office Savings Bank is one of them. When you have saved 1/– (or any larger sum) you can open a P.O. Savings Bank account, *i.e.* you can hand your 1/– over the counter of a Post Office and receive a record of the fact in a book. The next 1/– you save is entered in the same book, and gradually the sum mounts up. When you have £1 there your money begins to earn interest. The Government rate is $2\frac{1}{2}\%$ per annum with some modifications, viz. :—

1. Only a whole £1 can earn interest.
2. Interest is only paid for complete calendar months.

These three pieces of information can be combined in the statement : " Interest is $\frac{1}{2}$d. per complete £1 per complete calendar month."

Example :—

On Jan. 1st £5 : 8 : 0 is recorded in your book.

You pay in Feb. 20th £3 : 6 : 0
June 15th £4 : 9 : 0
Aug. 23rd £3 : 17 : 0

You draw out Mar. 3rd £2 : 10 : 0
Sept. 17th £5 : 0 : 0

Your interest for the year is :—

Jan.	5 halfpence.	Balance	Jan. 31st	£5 :	8 : 0
Feb.	5		Feb. 28th	£8 :	14 : 0
Mar.	6		Mar. 31st	£6 :	4 : 0
April	6		April 30th	£6 :	4 : 0
May	6		May 31st	£6 :	4 : 0
June	6		June 30th	£10 :	13 : 0
July	10		July 31st	£10 :	13 : 0
Aug.	10		Aug. 31st	£14 :	10 : 0
Sept.	9		Sept. 30th	£9 :	10 : 0
Oct.	9		Oct. 31st	£9 :	10 : 0
Nov.	9		Nov. 30th	£9 :	10 : 0
Dec.	9		Dec. 31st	£9 :	13 : 9

Total   90

You notice that the balance has gone up in December. This is because you have been " credited " with the interest of 3/9. This is a Savings Bank, and the interest is not sent to you at the end of the year but added to your savings. If you never paid in any more money, yet the sum in your account would gradually grow or accumulate because interest would be added every year. In the above account 4/6 would be added the next 31st December and another 4/6 the year after ; this would bring the balance up to £10 : 2 : 9, so the next year £10 would earn interest and 5/- would be added on 31st December that year and for 3 more years, after which it would be 5/6 per year.

Another way in which the Government encourages us to save money is by selling Savings Certificates, and your school Savings' Association helps you to save up to buy these.

The price of one series of certificates was 16/- each, and interest is credited according to the following table :—

At end of 1st year 4d.

During 2nd year 1d. every 3 months.

During 3rd, 4th, 5th, 6th years 2d. every 4 months.

During 7th, 8th, 9th, 10th, 11th, 12th year 2d. every 3 months.

At end of 12th year an extra 4d.

At the end of 8 years the certificate is worth £1 and is said to have matured. If you do not cash it, however, it goes on

earning interest till it is 12 years old. After that it will not earn further interest if it is your only certificate, but if you have others you may be allowed to keep them till all have matured, and in that case the older ones will earn 2d. every 3 months (or other small sum) while waiting for the others. This was the fifth series of certificates issued by the Government.

People who save money in larger sums open deposit accounts with their banks. On these accounts interest is allowed at an agreed rate, say 3% per annum, and is credited at regular intervals.

e.g. On 1st January, 1932, a man deposits £30 in the bank to earn interest at 3% per annum. The bank credits the interest half-yearly on 30th June and 31st December. What will the account stand at on 1st January, 1935 ?

Work as follows :—

	£30	Original principal.
$1\frac{1}{2}\%$ of £30	£ ·45	Interest credited June 30th, 1932.
	£30 ·45	
1% of £30 ·45	·3045 ⎱ ,, ,, Dec. 31st, 1932.
$\frac{1}{2}\%$ of £30 ·45	·15225 ⎰	
	£30 ·9067|5	
	·3090|67 ⎱ ,, , June 30th, 1933.
	·1545|33 ⎰	
	£31 ·3703|50	
	·3137|03 ⎱ ,, ,, Dec. 31st, 1933.
	·1568|51 ⎰	
	£31 ·8409|04	
	·3184|09 ⎱ ,, ,, June 30th, 1934.
	·1592|04 ⎰	
	£32 ·3185|17	
	·3231|85 ⎱ ,, ,, Dec. 31st, 1934.
	·1615|97 ⎰	
	£32 ·8032|99	

So on 1st January, 1935, the owner can draw from the bank £32 : 16 : 0, or perhaps 1d. more than this. Notice that many

figures on the right have been omitted because they represent such tiny fractions of a penny that it is useless to trouble with them.

This is an example of compound interest; all previous references to interest have been to simple interest, *i.e.* the same amount of interest is credited every time. In 3 years at 3% the *simple* interest on £30 would be £2 : 14 : 0 ; the compound interest if credited half-yearly is £2 : 16 : 0, as we have seen.

If a man can save £10 each year and deposit in a bank at 2% per annum, interest credited once a year only, at the end of 4 years he would own more than £40. He might work thus :—

£10	Banked at end of 1st year.
·2	Interest earned during 2nd year.
£10	Banked at end of 2nd year.
£20 ·2	Principal at beginning of 3rd year.
·404	Interest for 3rd year.
£10	Banked at end of 3rd year.
£30 ·604	
·61208	4th year.
£10	
£41 ·21608	

So he now owns £41 : 4 : 4 (nearly).

The bank clerk has to keep accounts which look something like the above sums, only instead of doing them all at once he adds a little bit each year or half-year.

But if you ask him when you deposit the money, say £250, how much it will amount to in 5 years' time, he will refer to a compound interest table, of which this might be a part :—

Amount of £1 for periods up to 6 years at the percentages stated.

Yrs.	2½%	3%	3½%	4%	4½%	5%
1	1·0250	1·0300	1·0350	1·0400	1·0450	1·0500
2	1·0506	1·0609	1·0712	1·0816	1·0920	1·1025
3	1·0769	1·0927	1·1087	1·1249	1·1412	1·1576
4	1·1038	1·1255	1·1475	1·1699	1·1925	1·2155
5	1·1314	1·1593	1·1877	1·2167	1·2462	1·2763
6	1·1597	1·1941	1·2293	1·2653	1·3023	1·3401

So £250 will amount to 250 times £1·1877 in 5 years at $3\frac{1}{2}\%$ and the clerk will say £296 : 18 (about).

But though the clerk does not himself work the sum, someone must have worked it or known how to do so—if you do not know whether adding or subtracting or multiplying or dividing has to be done you cannot make a machine or a table to carry out the process. If you are not interested in how this is done, and would rather use a table made by someone else, you can leave out the rest of this chapter, or you can read it without trying to follow the calculations.

All time-saving devices in connection with compound interest depend on the formula $A = PR^n$

where A is the amount at the end of the period.

P is the amount at the beginning of the period (usually called the Principal).

n is the number of years (or number of times interest is credited).

R is found by considering the amount to which the unit deposit would grow in one year (or one crediting).

In English money A and P will be measured in £ ; in American money they will be in $.

In the example worked on page 67 P is 30, n is 6. £1 put in the bank and left for one half-year would receive £·015 as interest, so R is 1·015.

Each of the small sums the crediting clerk did was equivalent to multiplying by 1·015—

$$30 \times 1·015 = 30·45$$
$$30·45 \times 1·015 = 30·90675$$

and so on.

But if you use the formula you will probably do the multiplication by logarithms, thus :—

$$
\begin{aligned}
\text{A (amount required)} &= 30 \times (1·015)^6 \\
\log \text{A} &= \log 30 + 6 \log 1·015 \\
&= 1·4771 \\
&+ \underline{\quad·0384} \\
&\quad \overline{1·5155} \\
\therefore \text{A} &= 32·77
\end{aligned}
$$

We must remember that we have used a 4-figure logarithm table, so our result is not dependable to more than 3 significant figures. To this degree of accuracy it is £32·8 = £32 : 16 : 0. This, of course, happens to be exactly the same result as we

obtained by the other method, but that is because only small numbers were involved. If you used the formula to find the amount of £3,560 invested at 4% per annum for 21 years you could only obtain a " round figure " answer with 4-figure logarithm tables. In constructing compound interest tables 7-figure logarithms would be used.

The formula can be used in other ways. For example, a father receives a large sum of money when his child is aged 8. He decides to save some of it to pay for a University course to begin when the child is 18. Suppose he thinks he will want £500 then, how much of his money must he place on deposit at 4% per annum, interest credited once yearly ?

Here A is 500, n is 10, R is 1·04 and we have to find P.

$$P = \frac{A}{R^n}$$

$$= \frac{500}{(1 \cdot 04)^{10}}$$

$$\log P = \log 500 - 10 \log 1 \cdot 04$$

$$= \begin{cases} 2 \cdot 6990 \\ - \cdot 170 \end{cases}$$

$$= 2 \cdot 5290$$

∴ P = 338·1. Remember that this result is approximate. So he will probably bank £340 for this purpose.

£340 is sometimes called the " Present value of £500 due 10 years hence," if money is " worth " 4%.

One object of saving money is to provide for the time when we shall no longer be able to work, and shall therefore have no earned income. The money we save for this purpose may be invested in stocks and shares, so that the dividends will form an income for us. But another way is to purchase an annuity from an insurance company (or the Government acting as such). On page 36 there is a reference to provision for old age by means of pensions, but we do not buy a pension, though we may contribute to it—it is paid by the person or institution for whom we worked in our earning days, or is granted to us under certain conditions out of charitable or community funds.

An annuity is similar to a pension once we have begun to receive it year by year, but its source is, or may be, different. It is arranged for as a business proposition in the same way

that life insurance is. By paying an annual premium during
his working years a man becomes entitled to a sum of money
every year of his life after he reaches 60 years (or other agreed
age). The risk which the company takes is that he may live
to be very old, perhaps 100, in which case they will have to go
on paying out the annuity for 40 years, probably long after
they have used up all the money that particular man had
saved, but then another annuitant may die when he is only
62, and the company holds enough of his savings to last till
he is (say) 72.

By studying very carefully the ages of all the people who die
during a long period—say 50 years—actuaries (mathematicians
who make this their special business) work out what they call
" the expectation of life," and from this the insurance companies
decide, after much calculation, at what prices they can afford to
sell annuities—usually the prices are different for men and
women, but the following is an example of a price list :—

Annual premium by which a woman may secure a pension of
£10 per annum.

Age next birthday.	Pension Age.			
	50	55	60	65
20 ..	£3 : 1 : 1	£2 : 2 : 8	£1 : 10 : 7	£1 : 1 : 5
21 ..	£3 : 4 : 4	£2 : 4 : 10	£1 : 11 : 11	£1 : 2 : 4
22 ..	£3 : 8 : 0	£2 : 7 : 3	£1 : 13 : 4	£1 : 3 : 4
23 ..	£3 : 11 : 11	£2 : 9 : 9	£1 : 14 : 11	£1 : 4 : 4
24 ..	£3 : 16 : 2	£2 : 12 : 3	£1 : 16 : 7	£1 : 5 : 5
25 ..	£4 : 0 : 9	£2 : 15 : 1	£1 : 18 : 4	£1 : 6 : 7
26 ..	£4 : 5 : 9	£2 : 18 : 0	£2 : 0 : 3	£1 : 7 : 9
27 ..	£4 : 11 : 4	£3 : 1 : 4	£2 : 2 : 4	£1 : 9 : 0
28 ..	£4 : 17 : 3	£3 : 4 : 11	£2 : 4 : 7	£1 : 10 : 5

Premiums for larger annuities are in proportion.

These are not fixed rates : every insurance company which
does this kind of business publishes its own list of prices.

Suppose a woman aged 23 decides to save £9 a year and
arranges with an insurance company to begin drawing an
annuity of £25 per annum when she is 55.

She will actually save £288. If she put it in a stocking it
would last less than 12 years at £25 per year, *i.e.* by the time
she was 67 there would be none left.

But the company will make it last longer by investing the

premiums as they receive them. Suppose they invest at an average rate of interest of 3% per annum.

Her first premium has earned the most interest. By the time she is 55 it has amounted to $£9(1\cdot03)^{32}$.

Altogether the company has accumulated on her account
$£9(1\cdot03)^{32}+£9(1\cdot03)^{31}+£9(1\cdot03)^{30}+\ \ .\ \ .\ \ .\ \ +£9(1\cdot03)$

$$=£\frac{9(1\cdot03)(1\cdot03^{32}-1)}{\cdot03}=£484\cdot4$$

This result is only approximate for two reasons :—

1. An *average* rate of interest has been used.

2. The calculation depends on 4-figure logarithms.

But it can be compared with the £288 actually saved. £25 is now deducted every year, but the rest of the money continues to earn interest.

The company's book-keeping might be something like this:—

£480	held.
25	paid out on 55th birthday.
£455	still invested at 3% (average rate).
13·65	interest for 1 year.
£468·65	
25	paid out on 56th birthday.
£443·65	still invested.
13·3095	interest.
£456·9595	

Two small sums are done each year—an addition and a subtraction. But to work out beforehand how long the money would last, a calculation more like the following would be made.

If the money is to last n years after that 55th birthday the present value of the last £25 must be $£\dfrac{25}{(1\cdot03)^{n-1}}$

The present value of all the annuities must be :—

$$£25+£\frac{25}{1\cdot03}+£\frac{25}{(1\cdot03)^2}+\ \ .\ \ .\ \ .\ \ +£\frac{25}{(1\cdot03)^{n-1}}$$

$$=£\frac{25}{(1\cdot03)^{n-1}}\ \frac{(1\cdot03^n-1)}{\cdot03}$$

This must be the same as £480.

$$\therefore \quad \frac{25}{\cdot 03} \left(1 \cdot 03 - \frac{1}{1 \cdot 03^{n \cdot 1}}\right) = 480$$

$$1 \cdot 03 - \frac{480 \times \cdot 03}{25} = \frac{1}{1 \cdot 03^{n \cdot 1}}$$

$$1 \cdot 03 - \cdot 576 = \frac{1}{(1 \cdot 03)^{n \cdot 1}}$$

$$\cdot 454 = \frac{1}{(1 \cdot 03)^{n \cdot 1}}$$

Using logarithms $\overline{1} \cdot 6571 = -(n-1)(\cdot 0128)$

$$n \ (\cdot 0128) = 1 \cdot 0128$$
$$- \cdot 6571$$
$$= \cdot 3457$$

$$\therefore n \ = \frac{3457}{128} \fallingdotseq \frac{432}{16}$$

$$\fallingdotseq 27$$

So the money will last till the woman is 82.

But, of course, this is the business of the insurance company, and similar calculations have to be made by Government departments administering pensions, but the people receiving pensions or annuities do not need to know so much about them.

In the same way, if you buy your house by instalments spread over a number of years the Building Society officials have to calculate how much must be paid each year by considering the effect of compound interest on the value of the earlier instalments. So, too, when a city corporation borrows £10,000 to build a school and agrees to pay off the debt in 20 years, the clerks have to take compound interest into account in calculating how much the rates must contribute to the sinking fund during each of those 20 years. If we assume that money is worth 4% the calculation might be made in this way :—

Let £P be paid off each year.

The present values of the various instalments are :—

$$£\frac{P}{1 \cdot 04}, \ £\frac{P}{(1 \cdot 04)^2}, \ £\frac{P}{(1 \cdot 04)^3}, \ \cdot \ \cdot \ \cdot \ £\frac{P}{(1 \cdot 04)^{20}}$$

Together these make $£\dfrac{P}{(1\cdot 04)^{20}}\dfrac{(1\cdot 04^{20}-1)}{\cdot 04}$

But the present value of the debt is £10,000

$$\therefore\ £\dfrac{P}{(1\cdot 04)^{20}}\dfrac{(1\cdot 04^{20}-1)}{\cdot 04}\ =£10{,}000$$

$$P\qquad =\dfrac{10{,}000\times(1\cdot 04)^{20}\times\cdot 04}{1\cdot 188}$$

$$=736\cdot 5$$

They would probably budget for £740 per annum.

Notice that the simple interest on £10,000 at 4% for 20 years is £8,000, and the amount £18,000, but by paying by instalments which can themselves earn interest (or by investing them to form a sinking fund) the net cost is £740 × 20 = £14,800.

EXERCISES.

1. For how many years has a trustee held £500 if he has paid out £250 as interest at 4% ?

2. How many years would it take for £500 to amount to £750 at 4% compound interest payable half-yearly ?

3. £50 is deposited annually for 10 years at 4% per annum and interest is credited half-yearly. How much has accumulated 15 years from the date of the first deposit ?

4. A man gives £20 to charity one year, and every succeeding year he gives £3 more than the last. How long will it be before his total donations reach £200 ? Would the time required have been longer or shorter if he had increased his donations each year by 3% ? Find the time in this case.

5. Find the sum necessary to buy a life annuity of £120 a year, interest being reckoned at the rate of 3%, if the payments are to begin at once and the insurance company takes no risks. In a certain case the company charges half this sum. Find the amount left undrawn if the recipient dies after enjoying the annuity for 15 years. How many more years would it have lasted without loss to the company ?

6.   The following are entries in a Savings Bank Book (P.O.). What interest will be credited on 31st December, 1933 ? 31st December, 1932.   Balance £10 : 17 : 3.   Paid in 25th January, 1933, £5.   17th June, 1933, £4 : 16.   6th August, 1933, £3 : 10.   Withdrawn 10th July, 1933, £6 : 15.   20th November, 1933, £8.

7.   A man borrows £445 from a Building Society to purchase his house, and agrees to repay 22/6 weekly for a period of 15 years.   If he sells the house after 10 years for £500 how much of this sum must he offer to the Building Society to get out of debt ?   (Take 3% as an average rate of interest, and credit it once a year only.)

8.   If a debt is left unpaid, and no interest is offered, how long will it be before the sum due is double the sum borrowed, when investments generally are yielding about 3% per annum ?

BANKING AS A BUSINESS AND AS A PUBLIC SERVICE

IN the course of this book the word " bank " has occurred many times—let us now stop and consider carefully exactly what a bank is and why it exists.

A bank is, in the first place, a business : it requires capital to start it, and it arranges for this capital by inviting people to subscribe and become shareholders. If you look on the money page of a newspaper you will see that bank shares are bought and sold just like the shares in any other business. It is true that a Government, or even an individual who has enough money, may on occasion do the same sort of business as a bank, but usually a bank is governed by a body of directors who are themselves shareholders and who act for themselves and the other shareholders exactly in the same way as the directors of, say, a boot factory do : they carry on business all the year, and when they have made up their accounts and there is a profit, they declare a dividend on the Ordinary Shares, and pay the agreed rate of interest on the Preference Shares.

But in what does their business consist ? What do they do to make a profit ? Primarily three things :—

1. They lend money to start other businesses and charge interest on it.

2. They take charge of the savings of their customers, and allow interest on the deposits.

3. They organize money communications, and make it easy to send money from place to place without carrying the coins about.

It is with the first two of these activities that we have up to now been concerned : the first when we were dealing with simple interest and investment ; the second in connection with the accumulation of money wealth and the crediting of compound interest. The two are not independent branches of the bank's business—for one thing, the bank must earn enough interest on the money it lends out to pay the interest on the

deposits it accepts, as well as to contribute to the profits of the business. So when you hear that the bank rate is 2% it does *not* mean that all sums in connection with banks will involve that percentage—that is the rate at which the Bank of England is prepared to lend money to other banks ; the rate allowed to depositors will be lower than this ; and the rate charged to other businesses will probably be higher. But if the bank rate itself goes up so will the other rates, and when the bank rate falls it is likely that the others will also fall. In fixing the rate at which money is lent to industry the bank authorities must consider the security offered—the money they lend is not their own : they are responsible for it to their shareholders and customers, so they cannot take the same risks which a private investor can take by accepting ordinary share certificates in return for their money—sometimes they become debenture holders, at other times they take charge of the title deeds of a house, or of certificates for some form of Government stock, or perhaps of valuable jewellery, as a pledge or security that they will some day be repaid. The pawnbroker who lends 5/- to a man who leaves his overcoat as security is acting as a banker for the poor man. When land is used as security it is said to be mortgaged (see page 63).

The third activity of the bank is rather different. It is day to day business, and is not concerned with long-term deposits or loans.

The machinery of money communications consists of current accounts, cheques, drafts and bills of exchange, and in studying them we must also study the customs of discounting bills and operating foreign exchange.

Let us suppose you, John Brown, wish to open a current account. You go to a bank, probably with an introduction from someone who is already a customer there, and hand (say) £30 over the counter. The cashier asks for a specimen of your signature and gives you a cheque book and, if you desire it, a paying-in book. He will charge you 2d. a page for the cheque book because there is a Government tax on the right to draw cheques, but you do not pay anything for the paper itself or for the printing on it—the bank provides that for its customers.

Each cheque form has an embossed stamp to show the tax has been paid and a number by which it can be identified. In addition it bears the name and address of the bank or

branch where your account is opened and a space for the date and for other details which have to be filled in when you use it. All over the groundwork of the form is a network of very small coloured lettering—probably the name of the bank repeated many times. This is not a necessary portion of the cheque, but is a precaution against fraud.

When you want to draw a cheque to pay Peter Smith £3 : 10 : 0 you fill up the form as follows :—

....BANK,   *April 1st, 1933.*
          MILSOM STREET, BATH.

Pay *Peter Smith*   or Order

the sum of

Three pounds, ten shillings ————————————————

£3 : 10 : 0.   *John Brown.*

2d.

On the counterfoil, which you keep, you write :—

" April 1st, 1933
Peter Smith
£3 : 10 : 0."

and any other notes you wish.

If you are sending the cheque by post, and wish to make sure that no one but Peter Smith can receive the money, you " cross " the cheque. It would then look like :—

....B|ANK, | *April 1st, 1933.*
          MILSOM STREET, | Not negotiable | B|ATH.

Pay *Peter Smith*   or Order

the sum of

Three pounds, ten shillin|gs ————————————————

£3 : 10 : 0.   *John Brown.*

2d.

If you always want to use crossed cheques you can tell the cashier so when you get your cheque book and the crossing will be ready printed for you.

Suppose Peter Smith also lives in Bath and you send him your cheque without crossing. He can go to your bank, write his name on the back (endorse the cheque), and the cashier will pay him £3 : 10 : 0 out of your money.

But if he lives in Cambridge, or if the cheque is crossed, his plan will be to go to his own bank and " pay in " the cheque, *i.e.* he endorses the cheque and fills up another form, and his bank credits him with £3 : 10 : 0 more than they held of his before.

Every bank receives many cheques in the course of a day. After hours they make a list of them and where they come from and send them up to London to be collected. Suppose ten cheques drawn in Bath have been paid in at Cambridge and together they represent £53 : 17 : 6. On the same day five cheques drawn in Cambridge, together worth £30 : 12 : 6, have been presented in Bath. Then on balance the Bath banks have to send £23 : 5 : 0 to the Cambridge banks. It does not work out quite so simply as this as a rule, but the illustration explains the principle on which the clearing house works. Most of the other banks run accounts with the Bank of England, and actually all balances are settled in London, and it is not often that money is actually sent from one town to another. Of course, each cheque has to be separately entered in the books of the banks, both where it is paid in and where it is drawn. If you wish to withdraw some of your own money you merely draw a cheque to Self, endorse it with your own signature, and cash it over the counter.

The bank does not usually allow interest on money on current account ; on the other hand, it does not charge anything for the type of work I have so far described so long as you are careful to leave enough money in its possession to meet all the cheques you draw. But if some day a cheque with your signature is presented for payment and they have not enough of your money to cash it they will mark it " R.D." (return to drawer), and the payee must consult you again to get his money. If, however, you have told the bank about the cheque before it is presented, and satisfied them that you really are rich enough to meet it and will soon be paying in some more to your account, they may allow you an overdraft, *i.e.* they will honour your cheque by lending you the money to meet it, and then they will charge you interest on the loan till you refund it.

Occasionally a cheque is made out to Bearer, instead of Order. This is not such a safe method, as anyone can then cash it by endorsing it with his own name, but the method is convenient for some purposes.

Your account with the bank is often kept in duplicate—the words " Credit " and " Debit " being differently used, according as the account is regarded from your point of view or from that of the bank.

When you pay in money, from your point of view, it is a credit, but until you withdraw it or authorize someone else to withdraw it by writing a cheque, the bank owes it to you, so they regard it as a debit or debt. Similarly the money you withdraw you would call a debit, but the bank is that much out of debt, and so puts the sum on the credit side of its books.

A draft is something like a cheque, but it is usually signed by a banker, and authorizes another banker to pay out money, *e.g.* if you are going to Ireland for a holiday and think you will want £25 when you get there, but do not wish to carry that amount of cash with you, you can take your £25 to the bank and ask for a draft to be made out payable to you in, say, Galway, and for a fee the banker will oblige you. Then when you reach Galway you present the draft and receive £25 for it.

In both these cases the bank holds the money before the order to pay it out is made. But if a trader orders goods from a factory and hopes to sell them at a profit he is often granted credit, *i.e.* he is not expected to pay for the goods at once, but only when he has had a reasonable chance to sell the goods and collect the money. In this case he does not write a cheque, but a bill of exchange is made out something in this form :—

May 15th, 1933.

Pay to the order of James Jones three months from date the sum of

eighty pounds at...*Bank, Newmarket.*

£80 : 0 : 0.

Patrick Jackson writes across this " Accepted " and his signature, and promises thereby that £80 will be available at the ——— Bank, Newmarket, on 15th August, 1933. He sends this bill back to James Jones, and it is then a complete bill of exchange and becomes " negotiable." The money cannot be claimed till 15th August, but it is not at all certain that James Jones will really wait till then for it. He may take the bill to a bill broker (or a banker acting as such) on any business

day—perhaps 6th July, 1933—and the broker will discount it for him at say $4\frac{1}{2}\%$. He will work the following sum :—

July 6th to 31st	..	..	25 days.
August 1st to 15th	..	..	15 ,,
Allow 3 days of grace	..	..	3 ,,
			43 ,,

Interest on £80 for 43 days at $4\frac{1}{2}\%$ per annum :—

$$£\frac{80\times43\times\ 9}{365\times200}=\frac{18\times43\times20}{73\times25}\text{ shillings}$$

$=8/6$ almost exactly. This is the banker's discount.

So he will pay James Jones £80 less 8/6, *i.e.* £79 : 11 : 6, and then when 15th August comes it will be the banker who will collect the £80 at Newmarket. Actually he cannot take action against Patrick Jackson if the money is forthcoming by 18th August, as three days of grace are allowed by law. The bill may change hands more than once : each person who receives money for it will endorse it. The first endorsement must be that of James Jones, in whose favour the bill is drawn.

£79 : 11 : 6 is the " present worth of £80 due 43 days hence at $4\frac{1}{2}\%$ per annum." This is a slightly different use of the expression " present worth " to that found on pages 28 and 70.

£79 : 11 : 6 invested at $4\frac{1}{2}\%$ for 43 days would produce—

$$£79\frac{23}{40}\times\frac{4\frac{1}{2}}{100}\times\frac{43}{365}\text{ as interest}$$

$$=£\frac{3183\times\ 9\ \times43}{40\ \times200\times365}=£\frac{28647\times43}{2920000}$$

$$=8/5\text{ to the nearest penny.}$$

```
        28647
           43
      ───────
       114588
        85941
292)123·1821(·4218
         638
         542
        2501
```

But the banker will get 8/6 when he claims the £80.

The banker's discount (or commercial discount) is always a little greater than the theoretical or true discount, but it is much easier to calculate. To find the " true " present worth

F

of £80 due in 43 days at $4\frac{1}{2}\%$ per annum we should work as follows :—

Interest on £100 for 43 days at $4\frac{1}{2}\%$ would be :—

$$£\frac{43}{365}\times\frac{9}{2}=£\frac{387}{730}$$

$\therefore$ Present worth of £100$\frac{387}{730}$ is £100

$$\qquad\qquad\text{,,}\qquad\qquad\text{,,}\qquad £80$$

is :— $£\dfrac{80\times100\times730}{73387}$

$=£79 : 11 : 6\frac{3}{4}$ nearly.

```
                     79 ·577
          73387)5840000
                702910
                424270
                570350
                566410
                 52701
```

You will see that this involves much more calculation, and that the practical difference in the result in this particular example is a mere nothing, so it is not surprising that the commercial world has adopted the other method when discounting bills, especially as the advantage is always to the bill-broker. Over the long periods considered in the previous chapter, and when compound interest is involved, the more mathematical use of the term " present value " is, however, general.

There is another very important part of money communications with which the modern banker has to deal, and this is foreign exchange. In Chapter I it was explained that money was invented to make the exchange of goods easy. When travelling was difficult exchanges did not often take place between different countries, and so it was natural that each country should have its own kind of money for use within its own borders. But nowadays civilized peoples use every day things which come from all parts of the world, and so the organization of foreign exchange is necessary.

Buying and selling between countries can only be based on agreement between the buyer and seller, and a Frenchman will not usually accept £1 notes or an English cheque in payment if you want a hat made in Paris. If you want to settle for just this one purchase you must buy the necessary number of francs from your banker. Suppose the price of the hat is 120 francs, and the banker tells you that the rate to-day is

85·43 francs to the £, then you or he must work the following
sum :—

$$£\frac{120}{85\cdot43} = £1 : 8 : 1$$

$$85\cdot43)\overline{120\cdot00}\ (1\cdot404(6)$$
$$34\ 570$$
$$39800$$
$$5628$$

Then if you pay him £1 : 8 : 1 he will write a draft for 120
francs which you can send to the Paris milliner.

That is a much simplified idea of how the exchange works.
If on the same day someone is setting off for a holiday in
France and wants to take £10 with him, he could buy with it
854·3 francs, and then he could go shopping in France without
further visiting the bank.

But notice that it must be on the same day. That is
because the rate of exchange between England and France
varies. Within England it is a law that £1 and 20 shillings
are equivalent ; in France 1 franc is always equal to 100
centimes—but there is no law as to how many francs shall
equal £1—the price can change from day to day and sometimes
from hour to hour just as the price of potatoes does—and on
the same day it need not be the same in two different places.

The following is a copy of part of a list of money rates in
London taken from *The Times* newspaper on 24th April,
1933 :—

Place.	Method of Quoting.	Par of Exchange.	April 22nd.	April 21st.
New York ..	$ to £	4·86⅔	3·78—3·85	3·83—3·93
Montreal ..	$ to £	4·86⅔	4·30—4·35	4·35—4·42
Paris	Fr. to £	124·21	88⅜—90	87¾—89¾
Brussels ..	Bel. to £	35·00	25—25⅜	24¹³⁄₁₆—25¼
Berlin	M to £	20·43	15⅛—15⅝	15¼—15⅝
Bombay	Per rup.	1/6	1/6—1/6¹⁄₁₆	1/6₃₂—1/6³⁄₃₂
Singapore ..	Per dol.	2/4	2/3⅝—2/3¾	2/3⅝—2/3¾

At that date Britain was off the Gold Standard (a phrase
to be explained in the next paragraph) and the U.S.A. had just
recently abandoned this standard too, though for a totally
different reason, and you will notice that on two consecutive
days the prices had changed considerably and that many of
the prices quoted are a long way from the par of exchange.
Some papers are even leaving out this column nowadays, as it

is based on the assumption that both the countries concerned are using a fixed standard. The top line, for instance, means that we ought to be able to buy as much gold with £1 as with $4·86⅔.

When a country is on the gold standard two things are generally implied :—

1. The official price of gold is kept constant in that country. This is done by fixing the gold content of the coinage.

2. Anyone demanding gold instead of other money can obtain it, *e.g.* when we were on the gold standard, if you took £1 to the Bank of England and asked for a gold coin in place of it they were bound to give it to you—now they could refuse you.

We left the gold standard because so many people were demanding gold and sending it abroad that the Government saw we should not have enough gold left to meet the demands —we could not stay on the standard. U.S.A. was not forced off the gold standard—what President Roosevelt did was to forbid the export of gold; but he need not have done so—his country had plenty to meet all the demands which were likely to be made on its resources.

If we return to a gold standard we need not fix the price of gold at the same level as before, *i.e.* we can stabilize the £ at a new value, or we can invent a new kind of money altogether ; then the par of exchange with other countries will have to be worked out again. France stabilized her franc at a new value after the Great War—if you have an arithmetic book printed before the change you will see that the par of exchange with London is there given as 25·22 francs to £1. Belgium invented a new money—she now quotes in belgae instead of in francs. Germany re-made her currency, but used both the old name and the old value in terms of gold.

The same sort of consideration applies to countries which have a silver standard—examples are India and Mexico. There are also a number of countries at the present day whose currencies are linked to sterling, *i.e.* instead of fixing the price of gold their Government fixes the price of an English £1.

Even when both the countries concerned are working on a gold basis the rate of exchange alters a little from day to day and is quoted regularly in the newspapers. The numerical examples so far mentioned involve only small sums of money,

but just as the banks of one town total up all the outgoing and all the incoming money on any particular day and strike a balance, so the financiers of each country have similarly to take account of all the transactions which take place, and if, on the whole, England owes France, say, £1,000 or 124,210 francs, then gold has to be sent across the channel to settle it. It has to be bar gold, not coins or paper money, which are only recognized in England, and it costs something to take it across— for argument's sake let us suppose the expenses including freight charges come to £20—then England is paying £1,020 instead of £1,000 to settle a debt of 124,210 francs, so she is paying at the rate of $\dfrac{124210}{1020}$ francs to £1 = 121·77 fr. to £1. The exchange in this case has moved against England and in favour of France. When you hear the expression " A £1 is only worth 14/– now in Paris," it means that the exchange has moved so much against England that you can only buy $\frac{14}{20}$ of 124·21 francs with £1. It is a vivid way of expressing this, and does not mean that you would part with a £1 note for 14 English shillings.

Sometimes by studying the rates of exchange an account can be settled more cheaply by making two exchanges.

e.g. Suppose a merchant in London on 22nd April (see table above) wanted to pay for a consignment of Canadian apples and had received a bill charging him $1,000 and payable in Montreal. He can buy Canadian dollars in London at $4·32½ to £1—if he does this the apples will cost him—

$$£\frac{10000}{43·25} = £\frac{40000}{173} = £231·214 = £231 : 4 : 3 \text{ approx.}$$

Alternatively he might buy U.S.A. dollars in London at $3·81½ to £1, cable to New York and there buy Canadian dollars at 100 Canadian to 87¾ U.S.A. To do this he would have to buy $877·5 (U.S.A.), and this would cost—

$$£\frac{877·5}{3·815} \quad £\frac{175·500}{·763} = £\frac{25071·429}{109} = £230·013 = £230 : 0 : 3 \text{ approx.}$$

Bills of exchange between one country and another are bought and sold by bill-brokers to carry out such transactions. The arithmetic concerned does not often have to be done by the general public, but in some arithmetic books you will find examples of this type to be solved by chain rule.

If 1/- is worth 3·66 dg. of pure gold, 1 rupee is worth 106·92 dg. of pure silver, and 1 oz. of gold is worth 33·31 ozs. of silver, what is the value of a rupee in English money ? These are not up-to-date figures.

The working would be as follows, every unit occurring on both sides of the chain :—

which runs $x/-$ $= 1$ rupee

Z   1 rupee $= 106·92$ dgs. of silver

Z   33·31 dgs. of silver $= 1$ dg. of gold.

Z   3·66 dg. of gold $= 1/-$

[N.B.—The ratio is the important fact, not the unit of measurement, so in the third line dg. has been put instead of oz. on both sides of the chain.]

$$\therefore \ x/- = \frac{1 \times 106·92 \times 1 \times 1}{1 \times 33·31 \times 3·66} \ \text{shillings} = 10·52\text{d}.$$

$\therefore$ the rupee is worth $10\frac{1}{2}$d.

One other common phrase must be discussed in this chapter : this is the meaning of bankruptcy and the customs connected with it. A man (or a business or a country) becomes bankrupt if his liabilities exceed his assets, *i.e.* if by ordering goods, or by signing cheques or other promises to pay, he has said or implied that he owes more money than he could pay by using up all his resources, whether these consist of deposit and current accounts at the bank, of goods which can be sold, or of promises which other people have made to him. Technically, however, the man is not considered a bankrupt directly he is in such a position, and sometimes his difficulties prove only temporary. But if his creditors get impatient, or if he himself regards the position as hopeless and unbearable, an application is made to a court of law that he shall be declared a bankrupt. [A fee has to be paid when the application is made—this is to prevent trivial cases from occupying the time of the courts.] A receiver is then appointed who takes charge of all the assets, turns them into money and distributes this as fairly as possible among the creditors. Suppose, for example, that a man's assets were £500 and that he owed £800, £400 of it to one creditor, and £20 each to 20 other creditors. If he was made a bankrupt he could pay $\frac{5}{8}$ of every debt or a dividend of 12/6 in the £, and he would be ordered to do this, because it would be much fairer that everyone should get something

than that the big creditor should get his whole £400 and some of the others nothing at all. Sometimes it takes quite a long while to " realise " (*i.e.* turn into money) all the assets, and perhaps an interim dividend of 5/– in the £ will be declared, and then later on a final dividend of 7/6 in the £1, but when the receiver is quite satisfied that all the assets have been distributed the bankrupt is discharged. If he then starts a new business and makes a success of it he is not legally obliged to pay the rest of the old debts, though if he proved very successful he might feel morally bound to do so.

Here are two examples of the sort of arithmetic associated with cases of bankruptcy :—

1. A bankrupt's debts amount to £3,427 : 6 : 8 and his net assets are only £2,184 : 18 : 6. What dividend can be declared ?

$$\frac{2184\frac{37}{40}}{3427\frac{1}{3}} \text{ of } \pounds 1 = \frac{87397 \times 3 \times 20}{40 \times 10282} \text{ shillings} = 12/9$$

2. A bankrupt can pay 8/10½ in the £. What will a creditor receive to whom he owes £1,527 : 13 : 4 ?

Dividend on £1,527⅔ at 6/8 ($£\frac{1}{3}$) in £1 is   £509 : 4 : 5·3
      ,,   ,,   ,,   2/– ($£\frac{1}{10}$) in £1   152 : 15 : 4
      ,,   ,,   ,,   2½d. ($\frac{1}{32}$ of 6/8)   15 : 18 : 3·2

                                                                    _____

                                                                    677 : 18 : 0·5

                                                                    _____

So the creditor will receive £677 : 18 : 0½ (unless they decide not to deal in fractions of 1d.).

EXERCISES.

1. Look up the market prices of the bank shares in the five big banks of this country, noting any which are not " fully paid."

2. What different kinds of business have you seen transacted at the savings bank and money order part of a G.P.O. counter ?

3. What would have been paid for a bill of exchange drawn on 29th February, 1932, for $685 payable 3 months from date and discounted on 15th March, 1932, at 4½% ?

4.   What is the nominal value in £ : s. : d. at par of a debt between this country and U.S.A. quoted at $3,000 ?

5.   How much will it cost an English merchant to settle this debt to-day ?

6.   What dividend can be declared if a bankrupt's liabilities are £3,456 : 15 : 0, and his assets are valued at £2,437 : 6 : 8 ? How much will a creditor receive in lieu of £567 : 4 : 10 ?

7.   A letter is received containing paper payment of £7 : 10· Explain what the recipient must do if the enclosure is (*a*) a crossed cheque, (*b*) a money order, (*c*) several postal orders, (*d*) a banker's draft, (*e*) some other form of currency which you must specify.

THE MECHANIZATION OF ACCOUNTANCY

THE power of " looking before and after " is a characteristic of mankind. Primitive man kept his accounts and his plans in his memory ; civilized man enlarged his memory by keeping written records, and increased his power of calculating—forecasting a count—by the invention of a convenient way of writing down numbers, which is called the decimal notation. This has become so generally known that many people, seeing a row of figures and certain signs, proceed to calculate with them without making the least mental effort to understand what number is involved. There is value in having such a mechanized mind, but thinking man has gone a stage further, and by transferring such mechanical work to a machine outside himself has released his own mental powers for still further development.

The earliest of such aids to calculation is known as a " ready reckoner "—it is a tabulated statement of certain frequently-occurring calculations to which reference is easy. Simple ones were used a generation ago for household accounts and the payment of wages, but with the spread of education for girls they are less general now. Compound interest tables and insurance tables are, however, used in banks and offices, and in some form are several centuries old—it was, indeed, to simplify a compound interest table that Simon Stevin (in 1584) first used the extension of the decimal notation to fractions. Other particular businesses and trades have their own specially compiled tables.

But the evolution of the calculating machine has advanced far beyond this. In the modern bank or business house dealing with large sums the clerks no longer add by remembering that 4 and 3 make 7—instead they tap out on the keyboard of a machine long rows of figures and, as if by magic, their sum-total appears in print in its appointed place.

For those who are interested in the history of this development a visit to the Science Museum at South Kensington is recommended. A few notes on the principles involved may be added here. When the key 3 in the unit's place is depressed a

certain wheel turns through a fraction of a revolution, the depression of 4 makes it turn farther, another depression of 3 makes it complete its revolution, and another wheel which is geared to it begins a revolution to record the fact. The machine may consist of any number of such geared wheels—if there were six of them the highest number it would add up to would be 999,999 ; with ten wheels it could be used for numbers up to 9,999,999,999.

But when it is to be used for adding money some means of dealing with items smaller than the unit becomes necessary. The same machine can be used if these items are expressed as decimal fractions of the unit—thus the machine with ten geared wheels referred to above could be used for adding sums of French money, expressed in francs and centimes, up to 99,999,999·99 Fr. by the simple device of remembering that as the machine does not print the decimal point it really does the work in centimes.

British business houses, however, could only make use of such an adding machine if the clerk first expressed the sums of money in decimal form as in the note at the end of this chapter. Even so, he would have to decide on the degree of accuracy at which he would aim, for not all sums of shillings and pence *can* be exactly expressed as terminating decimals of £1.

To avoid these difficulties for the clerks special money machines are made in which the wheels on the right are geared so that the first only completes its revolution and starts the second turning when twelve pence have been tapped out, and the second is capable of adding twenty shillings before its gearing affects the third. The necessity for these special machines makes mechanical accountancy more expensive in England than in, say, America, and is one of the arguments for altering our system of money to a decimal system.

But whether we handle small sums and make our calculations mentally, or whether we are concerned with big business and entrust our sums to a machine, all citizens to-day have some responsibility for money : it were well for the world if all realized it as a responsibility and ceased to seek mere tokens of wealth. We owe much to the men of the past who have built up our money systems, but we requite them ill if we forget that these systems were intended to serve mankind and not themselves to become the objects of his devotion.

NOTE ON THE DECIMALIZATION OF ENGLISH MONEY.

(*a*) Theoretical method. Working written down in full :—

Express £5 : 6 : $10\frac{3}{4}$ as a decimal of £1.

$$4)3 \ \text{farthings}$$
$$\overline{\cdot 75} \ \text{pence}$$
$$12)10\cdot 75 \ \text{pence}$$
$$\overline{\cdot 8958\dot{3}} \ \text{shillings}$$
$$20)6\cdot 8958\dot{3} \ \text{shillings}$$
$$\overline{\cdot 344791\dot{6}} \ \text{pounds}$$

Result £5 $\cdot 344791\dot{6}$

(*b*) Using the memory as far as possible :—

Verify and learn $2/- = \pounds\cdot 1$

$6d. = \pounds\cdot 025$

$\tfrac{1}{4}d. = \pounds\dfrac{\cdot 025}{24} = \pounds\cdot 001\tfrac{1}{24} = \pounds\cdot 001041\dot{6}$

$\therefore$ £5 : 6 : $10\frac{3}{4} = £5 + 3$ florins $+ 43$ farthings.

$$= £5\cdot 343\tfrac{43}{24} = £5\cdot 344791\dot{6} = £5\cdot 345 \text{ correct to}$$
$$3 \text{ decimal places.}$$

It is worth while to practise being able to write a decimal like this at sight correct to 3 decimal places.

Here are the rules :—

1. Write the pounds as they are.

2. Divide the shillings by two (one or two digits obtained).

3. Turn the rest of the sum to farthings (one or two digits obtained).

If the number of farthings is below 12 add 0 (since the fraction omitted is less than $\frac{1}{2}$).

If the number of farthings is between 12 and 36 add 1 (since the fraction omitted is between $\frac{1}{2}$ and $1\frac{1}{2}$).

If the number of farthings is over 36 add 2 (since the extra fraction is over $1\frac{1}{2}$).

4. When two digits are obtained in each of (2) and (3) add the right-hand digit of (2) to the left-hand digit of (3).

e.g. Decimalize £9 : 17 : 7¾.

Result £9·882 [think of £9, £·85, £·031⎤
                                            £·001⎦

As a check on (3) above write or think of the pence over 6 :

thus 7¾d. gives $\dfrac{7\frac{3}{4}}{6}=1+\dfrac{1\frac{3}{4}}{6}$ (add 1 only)

9½d. gives $\dfrac{9\frac{1}{2}}{6}=1+\dfrac{3\frac{1}{2}}{6}$ (nearer 2).

To re-convert a decimal fraction of £1 into shillings and pence :—

(*a*) Theoretical method.   £6·778316
                                        20
                               ————————
                             15·566320 shillings
                                      12
                               ————————
                               6·79584 pence
                                     4
                               ————————
                               3·18336 farthings
                               ————————

Result £6 : 15 : 6¾.

(*b*) Direct method.   Express in £ : s. : d. to the nearest 1d.
£11·5938.

Think of £11+£·55+£·044.   43·8
Result £11 : 11 : 10½ (just over).   1·7
          £11 : 11 : 11   ————
                                           42·1

Note that we think of 44 farthings (more than 36) and subtract 2, and it is necessary to examine more closely to decide whether the result is over or under 10½d.   The quickest way to do this is to work $\frac{24}{25}$ of 43·8, but you may prefer other methods, such as working 10½d.=£·04375.

EXERCISES.

1. Make a ready reckoner showing the weekly rents payable for yearly rents ranging from £20 to £50 (31 calculations required).

2. Describe any calculating machine which you have seen at work.

3. Procure a compound interest table and study its arrangement. Use it to find the interest on £53 for 5 years at $3\frac{1}{2}\%$ per annum.

4. Decimalize £13 : 5 : $6\frac{3}{4}$, £17 : 15 : 10, £2 : 8 : $3\frac{1}{4}$.

5. What to the nearest penny is the value of (i) £10 ·56283, (ii) £11 ·87561, (iii) £24 ·71829, (iv) £56 ·49982, (v) £17 ·63875 ?

ANSWERS TO EXERCISES

1.
2. 15/6.
3.
4. Russia, India, India, Turkey, Sweden.
5. £44 : 14 : 4.
6. £7 : 2 : 8.
7. 27 fr. 30.
8. $3·25.

1. 12, 20, 144.
2.
3. (a) Myself, (b) a working dressmaker, (c) a clothing manufacturer.
4. 2/11½.
5. £1,700 : 2 : 1.
6.

1. 23/7. 3/– each way.
2. 10d., 4½d., 8d., 2/4.
3. £228.
4.
5.
6. £4 : 2 : 0, £4 : 12 : 0, £4 : 18 : 0.
   No. £3 : 9 : 0, £4 : 4 : 0, £4 : 12 : 6.

1. 16/8. 4⅓%.
2. 9/2.
3. £98 : 11 : 8.
4. £10 : 1 : 10½.
5. 3 years.
6. 3/9. 2/10½.
7. Yes. £13 : 1 : 0 to pay £13.

CHAPTER V

1.
2.
3. 14/7. £27 : 14 : 2.
4. £3 : 2 : 6 (allowing £70 for children, and other rates those used in the text of the book).
5. No, she has drawn 2/2 more than she has contributed.
6. 9d., 1/7, 10½d., 2/10½ in the £.

CHAPTER VI

1.
2. £5 : 13 : 6.
3.
4.
5.
6.
7. £714.
8. $19.

CHAPTER VII

1. $\frac{3}{2}$, 3/6$\frac{3}{4}$, 6$\frac{1}{4}$d., 11$\frac{1}{2}$d.
2. 4/6$\frac{1}{2}$, 12/2$\frac{1}{2}$, 67/–, 4/9, 12/9, £3 : 10s.
3. About £11 : 10s. probably, but possibly £10 : 1 : 6.
4. 18$\frac{6}{11}$%.
5. £68 : 6 : 9, £12 : 18 : 3.

CHAPTER VIII

1. Increase £69 : 1 : 9.
2. £64 : 7 : 4, £35 : 12 : 8.
3.
4. Increase then only £66 : 17 : 5.
5.
6. No—the promised yield is only 3·86%.
7. £4 : 7 : 2$\frac{1}{2}$.

CHAPTER IX

1. 12$\frac{1}{2}$ years.
2. 10$\frac{1}{2}$ years.
3. £760.
4. 7 years ; 9 years.
5. £4,120 ; £918 ; 8 years.
6. 6/9.
7. About £280.
8. About 24 years.

CHAPTER X

1.
2.
3. $678 ·41.
4. £616 : 8 : 9.
5.
6. 14/1 in the £ ; £399 : 8 : 8.
7.

CHAPTER XI

1.
2.
3. £9 : 18 : 11.
4. £13 ·278125 ; £17 ·7916̇ ; £2 ·4135416̇.
5. (i) £10 : 11 : 3 ;   (ii) £11 : 17 : 6 ;   (iii) £24 : 14 : 4 ;
    (iv) £56 : 10 : 0 ;   (v) £17 : 12 : 9.

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